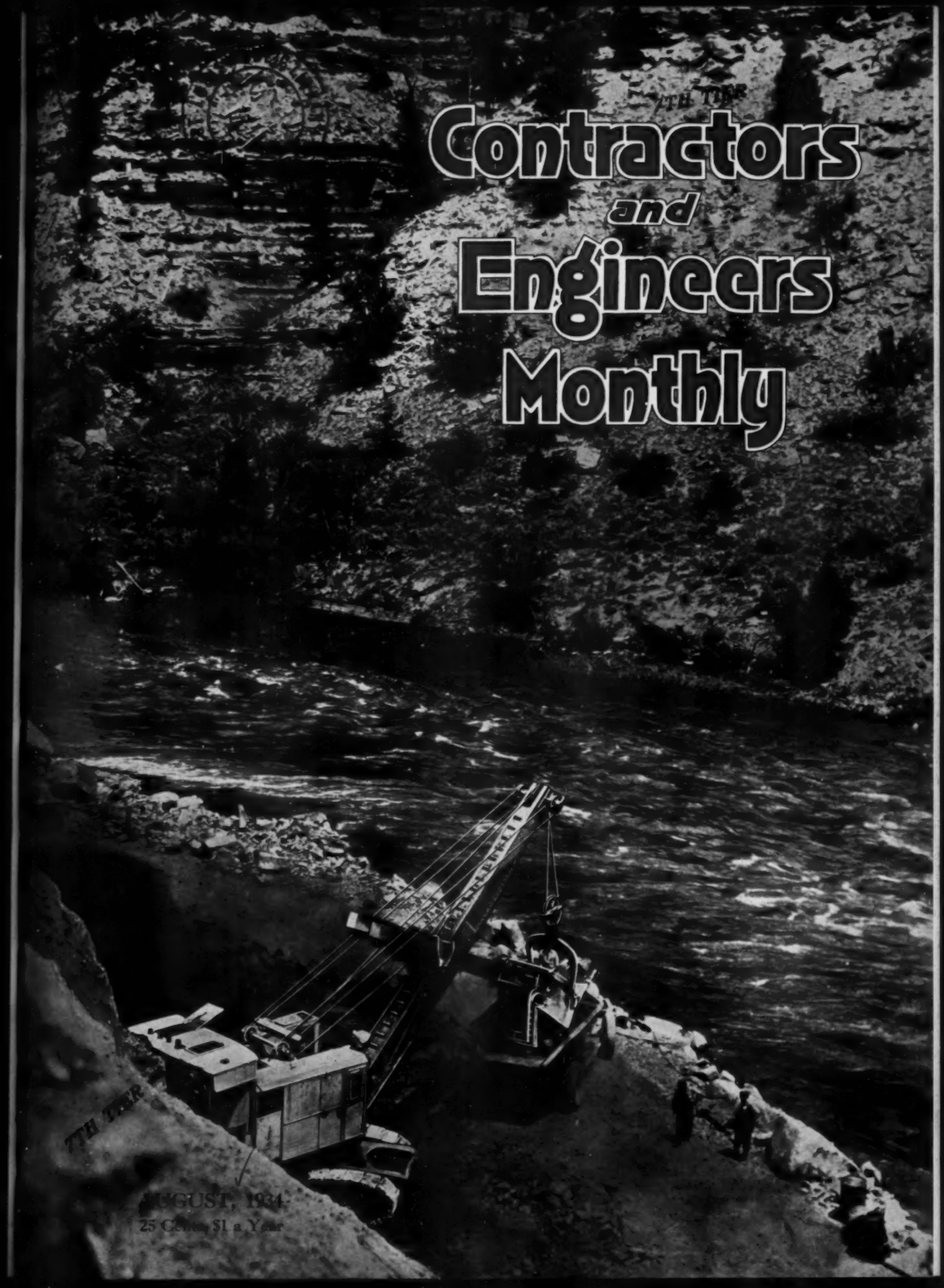

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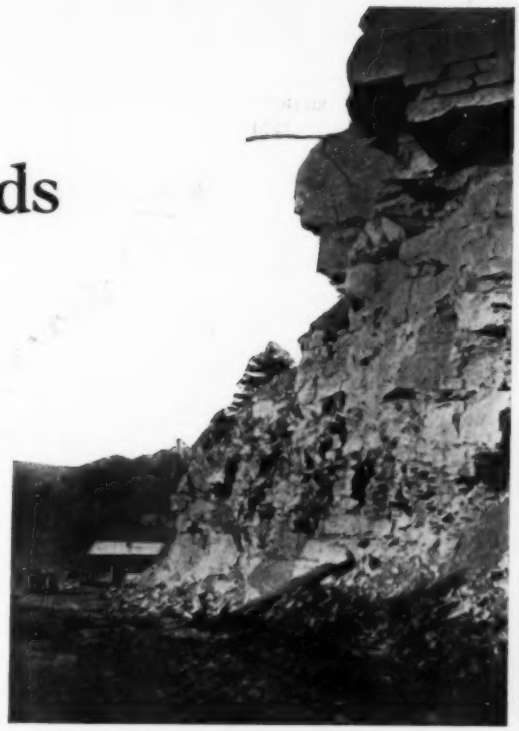
Blasting 209,500 Cubic Yards *of* Rock *on a* New York Highway Project



A 10.5-Mile Link of Port Jervis-Binghamton, N. Y. Highway Straightened and Widened

FEATURED by a daylight cut 1,700 feet long, involving the excavation of 137,250 cubic yards of rock, the Minnisink-Narrowsburg highway in Sullivan County, N. Y., is one of the most interesting road projects in the East in recent years. Designed as a shorter link in the route from Binghamton, N. Y. to New York City via Port Jervis, this new 10.5-mile stretch is almost a straight line from Minnisink to Narrowsburg, roughly paralleling the course of the Delaware River between these two points.

The contract was let in October, 1931, and the specifications called for a 38-foot roadway with a 20-foot pavement. A crushed stone base 6 inches thick provided the foundation for a surface course of bituminous macadam 3 inches thick. The penetration required was 2 gallons per square yard of pavement. Much of the stone used for the base, a hard blue sandstone with a high crushing strength, was obtained by crushing some of the material blasted from the heavy cuts.

A View of the Large Daylight Cut Completed

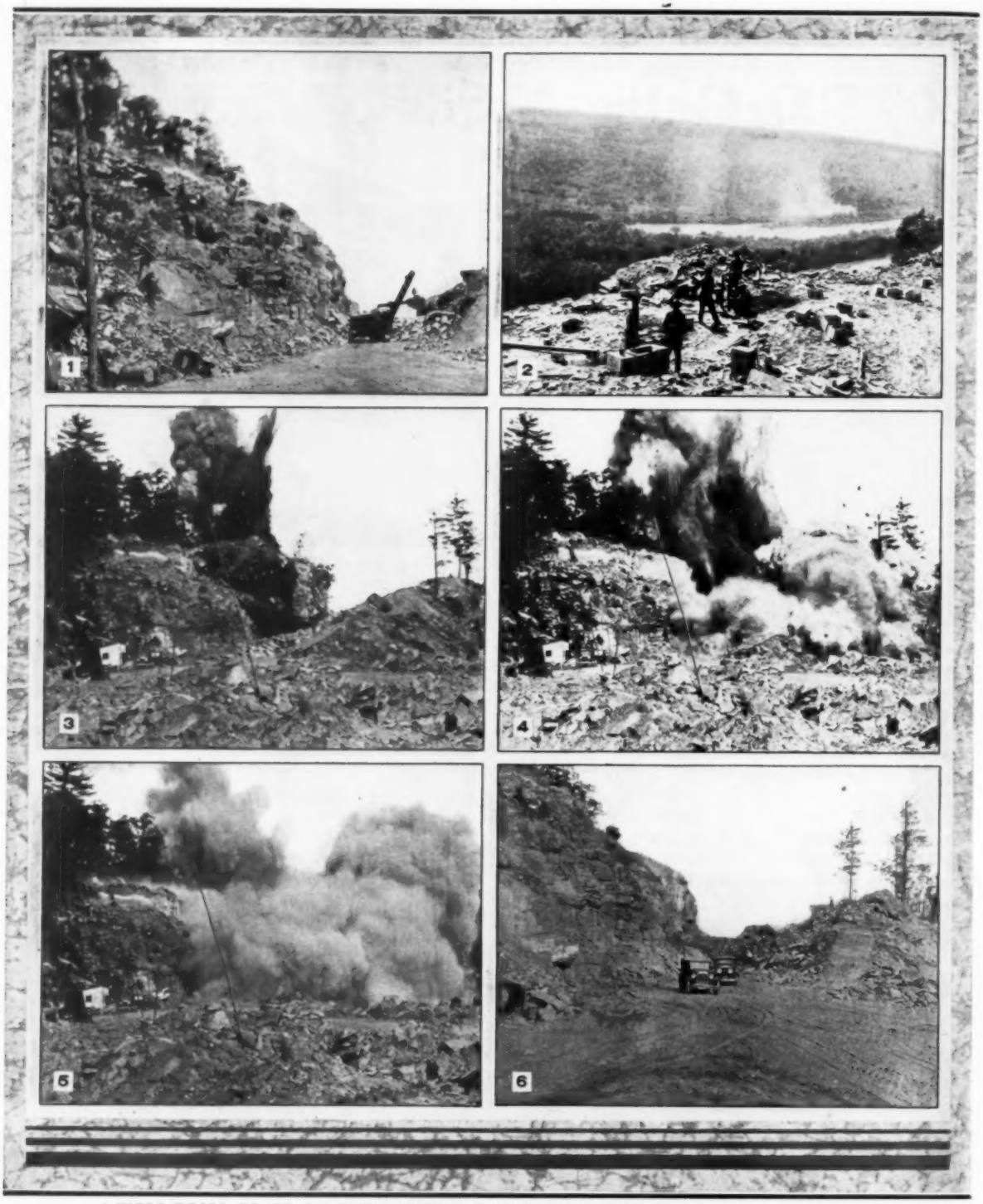
Explosives played a most important part in this project inasmuch as there were numerous cuts to make through the blue sandstone. With 209,500 cubic yards of rock out of a total of 580,000 cubic yards of material in the entire project, it is obvious that considerable blasting was required during the work. A total of 104,400 pounds of explosives was used, including 34,850 pounds of Hercules Gelamite A in 4 x 16-inch cartridges, 17,150 pounds of 40 per cent Extra L. F. dynamite in 4 x 16-inch cartridges and 52,400 pounds of 40 per cent Extra L. F. dynamite in 1¼ x 8-inch cartridges. The average amount of rock blasted per pound of dynamite was 2.1 cubic yards, which is considered good breakage in work of this type.

Well-drill holes were sunk for most of the primary blasting, while small holes were used for the secondary shooting and other blasting which required 1¼ x 8-inch cartridges of dynamite.

Drilling and Blasting Methods in the Big Cut

A study of the drilling and blasting methods in the large daylight cut presents the typical blasting proced-

ure for the entire project. This particular cut was 1,700 feet long and required the excavation of 137,250 cubic yards of rock. It was cut through a mountainside, making it necessary in some instances to sink well-drill



A WELL-DRILL BLAST ON THE LARGEST DAYLIGHT CUT ON THE OWEN P. WILLIAMS CONSTRUCTION CO. CONTRACT

1. Before the blast. The shovel is almost without rock; well-drill holes have been sunk in the rock on the left side of the cut. 2. The loading crew putting in the explosives in 4 x 16-inch cartridges. The holes were drilled on 16-foot centers to depths ranging from 30 to 65 feet. 3. With the machinery moved out of danger, the blast is fired and the charges are shown beginning to heave out the solid rock. 4. The second phase of the blast, showing how the dust from falling material mingles with the dynamite fumes. 5. It is all over—merely waiting for the air to clear so that the results can be inspected. 6. The result of the shot — rock nicely broken and ready for the shovel to move it.

holes 65 feet to get down to grade. A 5⅝-inch Cyclone No. 14 well drill was perched on top of the rock to be blasted. Working in single rows, perpendicular to the right-of-way of the road, the drill put in holes on 16-foot centers, allowing a 20-foot burden for each row. Usually four holes were required, with the depth ranging from 30 to 65 feet. The holes were sprung to allow larger charges to be placed at the bottom.

Gelamite A was used in the bottom of the holes, because of its smashing effect and also to meet the water conditions encountered. About one half of the charge in each hole was Gelamite A in 4 x 16-inch cartridges and the remainder of the charge was 40 per cent Extra L. F. dynamite, also in 4 x 16-inch cartridges. This charge worked out successfully in the cut with the loading ratio of 9.96 pounds of explosives per foot of hole. In all blasting in the cut, the breakage was 1.3 cubic yards of rock per pound of dynamite.

After going through the cut with well drills, blasting 20 feet of burden with each row, further blasting was required to get the "daylight" effect. This may be likened to the setback buildings in large cities where the higher the building the farther the upper stories are set back from the street line. In applying this principle to a cut, the contractor demonstrated the practicability and safety of this method, as it allows plenty of sunlight to get inside the cut. Thus, in winter, ice and snow are rapidly melted both on the roadway and on the sides of the cut. It is a well-known fact that the freezing of water in rock crevices causes rocks to break and shatter, and these in turn cause rock slides which may endanger moving traffic. By setting back the sides of rock cuts in the first place, and allowing the sun to beat on it, the hazard of falling rock from this cause is virtually eliminated. Another safety factor in this type of cut is that there is no overhanging rock to fall at any time because the sides are blasted so far back from the road.

In the 1,700-foot cut the sides were made on a 1-to-1 slope, much of the trimming being done with small drills. The holes were charged with 1¼ x 8-inch cartridges of Hercules Extra L. F. dynamite, the size of the charge and depth of the hole depending upon the local conditions. With a roadway 39 feet wide the cut was 173 feet wide at the highest point about 85 feet above the road.

Heavy Equipment

This project required heavy equipment and facilities. A stone crushing plant, a quarry, a fleet of tractors and trucks, in addition to the regular paving equipment, were among the important items which enabled the contractor to make good time on the project. Included in the equipment used were one Ingersoll-Rand 310-cubic foot air compressor on a 4-wheel rubber-tired trailer, another Ingersoll-Rand 220-cubic foot compressor and a Sullivan 220-cubic foot compressor. There were four Chicago Pneumatic, six Ingersoll-Rand, and two Worthington jack hammers and drills, an Electric Arc Cutting & Welding Co. welding set mounted on a truck and a Cyclone No. 14 Junior well drill with 5⅝-inch bit. There were two Acme stone crushers, one with a 24 x 40-inch jaw and the other a 24 x 16-inch unit. There were nineteen Linn tractors for hauling, one of them equipped with a diesel engine and six with special end-dump bodies, all with a capacity of 7 cubic yards. The remainder of the hauling fleet consisted of five Mack trucks, a Walter 4-wheel drive truck and a White truck, five International trucks and five smaller units. The excavating equipment included one Marion 1¼-yard gas-electric shovel in the quarry, a Koehring 1¼-yard shovel, a 1-yard and two ¾-yard Koehring shovels.

Moving the Rock Out of a Heavy Cut

Wherever possible, local labor was employed on the job. Under normal conditions, 100 men comprised the payroll. Early in October, 1933, however, when the asphalt was being laid, and trimming was under way, the labor roll jumped to 160 men. At this time, top surface was laid at the rate of 1,500 linear feet per day. As soon as weather conditions improved last spring, a final top coat of 1½-inch macadam completed the roadway, finishing one of the most important road projects undertaken in recent years in New York.

Personnel

O. P. Williams Construction Co., Oneonta, N. Y., was the contractor for this project under the personal direction of O. P. Williams, with C. T. Fisher, Engineer of the company, in charge of the details of construction. For the New York State Department of Public Works, William H. Goble was Engineer in charge.

Acknowledgment: The illustrations for this article were furnished through the courtesy of *The Explosives Engineer.*

The feature article of the September issue will be a description of the work on the Cape Cod Canal Highway Bridges in Massachusetts, one of the outstanding construction projects in the East. Watch for it!

Drill Operating at the Quarry Face

Heavy Excavation Furnished Material

SAN GABRIEL DAM No. 1, which it is said will contain the largest volume of rock fill ever undertaken, is now well under way. It is located on the San Gabriel River, 7 miles north of Azusa, California, and is being constructed by the Los Angeles County Flood Control District for the purpose of flood control and water conservation. A smaller dam, San Gabriel No. 2, has already been completed farther up the river for the same purpose.

Dam No. 1 will be 900 feet thick at the base, 30 feet thick at the crest, 1,670 feet in length and will rise 300 feet above the stream bed. The upstream slopes will be 1.3 to 1, 1.35 to 1 and 1.4 to 1. The downstream slopes will be 1.4 to 1, 1.5 to 1 and 1.6 to 1. The total open cut excavation at the site is 1,856,000 cubic yards and the volume of fill will be 5,213,000 cubic yards of dumped rock and 349,000 cubic yards of packed rock. The placed rock section will be 50 feet thick at the base and 10 feet thick at the crest, the rock in this section ranging in size from chips to boulders 10 tons in weight. The reservoir will have a capacity of 62,000 acre feet and will drain an area of 203 square miles above the dam. The area of the reservoir will be 600 acres.

A 10-inch Byron-Jackson pump was used in sluicing down the stripped bedrock on the dam site and other pumps of the same make, as well as Worthingtons and

The Quarry Road, Tunnel Portal, Gravel Plant and Shops with the Dam Site in the Background

for

Rock-Fill Dam

By
Joseph C. Coyle

Safe Methods in Handling Explosives

Domestics, were used in dewatering the excavation. The cut-off trench along the upstream heel of the dam is 20 feet to 40 feet deep and is to be filled with concrete. Waste material from the west abutment of the main dam was used to make a blanket fill in front of the spillway.

The Diversion Tunnel

The diversion tunnel, driven by Morrison & Knudsen of Boise, Idaho, subcontractor, is 1,848 feet long and 34 feet in diameter overall, with a 24-inch reinforced concrete lining. A pioneer bore 12 feet in diameter was first holed through, using ten Worthington and Gardner-Denver stopers in drilling, with four Ingersoll-Rand jack hammers for dry work and with screw feed wet heads. Three Sullivan and one Ingersoll-Rand compressors furnished air for the pneumatic equipment. Thirty-two 10-foot holes were usually drilled and shot with Hercules, Giant, or Apache blasting powder in the pioneer heading at a round. The drill steel was heated in a Gardner-Denver furnace and sharpened with an I-R machine. Material was loaded by two Conway muckers into 2½ and 3-yard rebuilt side-dump mine cars which were hauled by three Mancha battery locomotives.

In ring shooting the tunnel to final size, the Worthington pneumatic-feed drills were mounted on double

Shovels, Draglines and 20-Yard Trucks Working on Excavation in the Stream Bed

clamp columns and the ring holes were drilled 6 inches beyond the theoretical excavation line. Three to six rings of twenty-five holes each and spaced 4 feet apart were shot at a time. A Marion 20 tunnel shovel, operated by air, loaded the muck into 6-yard Autocar trucks.

The entire tunnel was lined as well as full sections in the softer areas where timbering was necessary in driving the pioneer bore. Reinforcing bars were spaced 18 inches both ways in a single ring 8 inches from the face of the concrete, which was placed with a ¾-yard Pressweld pneumatic placer. The aggregates for the concrete were washed river gravel produced at a plant installed near the tunnel portal by E. M. Hawley of San Juan Capistrano. A Fairbanks-Morse weighing hopper and two 1-yard Smith tilting mixers were used at the plant. The concrete was hauled in 4-yard hopper body dump cars pulled by a Whitcomb 8-ton gas locomotive. The steel forms were furnished by the Western Pipe-Blaw Knox Corp.

THE DIVERSION DAM

Waste material from the tunnel and the stream bed was hauled in trucks to build a diversion dam 500 feet long and 65 feet high at the entrance to the diversion tunnel. The site for the dam was excavated to bed rock at the upper face and concreted to the stream level. The fill was faced with laminated wood and asphaltic matting.

ROCK FOR THE DAM FILL

To obtain rock for the dam the contractor constructed a road about a mile long and 30 to 50 feet wide, with a maximum grade to 8 per cent, leading to the top of the quarry near the downstream portal of the diversion tunnel. This quarry, a large section of the mountainside, is approximately 600 feet high and 1,000 feet long and will be worked to a width of about 700 feet. The equipment was first moved to the apex of the quarry over a pioneer road, and stripping was begun while the roadway was being made, the strippings being wasted on the mountainside near the quarry. The quarry is being brought down in benches from the top.

In order to produce large rock, three Bucyrus-Armstrong well drills are used, supplemented by a number of Gardner-Denver air drills, supplied with air by five portable G-D compressors. The drill holes range in depth from 20 feet with the air drills to 50 feet with the well drills. Black powder is generally used, but springing with 20 and 40 per cent stick dynamite is done in some instances. Particular attention is given to safety, the explosives being taken to the quarry in specially-constructed wooden sleds with covered bodies, and the caps are kept at a safe distance from the powder sleds.

In spite of the size of this project, all the rock for fill is hauled by truck. The contractor is using a fleet of specially constructed Mack dump trucks, with 20-cubic yard bodies, both in hauling from the excavation and from the quarry. Several 7-yard Mack dump trucks are also in use on the job. Material is loaded from the stream bed and the quarry by six Bucyrus-Erie shovels, including two 120-B electrics, three 52-B diesels and a 37-B gas unit. Shops 50 x 282 feet were erected below the dam site and are well equipped with standard equipment for servicing and repairing the truck fleet.

FINAL WORK ON THE DAM

The dam will have a laminated facing of 6-inch Gunite slabs, varying in number from six slabs at the base to two slabs at the crest. This facing is intended to give flexibility while the dam is settling, and a connection will be made between it and the cut-off wall by means of a hinged "floater" slab. Outlets will be eight butterfly valves, discharging into a tunnel 30 feet in diameter which was driven through the east abutment and used as a bypass during construction. The spillway at the west end of the dam will be constructed under a separate contract.

PERSONNEL

The West Slope Construction Co., Azusa, Calif., is general contractor for this project. D. A. Daly is General Superintendent for the contractor, with E. S. Whitney, Superintendent at the dam and B. E. Barnhill, Chief Engineer at the dam. E. C. Eaton is Chief Engineer for the Flood Control District, with K. J. Harrison Resident Engineer at Dams No. 1 and 2.

Excavation on the Dotsero Cut-off

ON June 16, the $4,000,000 Dotsero cut-off and Moffat Tunnel, which eliminate 175 miles, and 8 hours' traveling time from a transcontinental railroad route, were dedicated. Bids for this 38.5-mile project were opened on October 15, 1932, at Denver, Colo., by the Denver & Salt Lake Western Railroad, and the contract awarded October 17, 1932, to three western firms who submitted a joint bid for the work. These included the Utah Construction Co., Ogden, Utah, W. A. Bechtel Co., San Francisco, Calif., and Morrison-Knudsen Co., Boise, Idaho. The operating company organized to handle the contract was known as Utah-Bechtel-Morrison, Inc.

The Dotsero cut-off follows the Colorado River from Orestod at an elevation of 6,700 feet on the Denver & Salt Lake Railroad, 128.4 miles west of Denver, to Dotsero at an elevation of 6,187 feet on the Denver & Rio Grande Western Railroad near Glenwood Springs, Colo., eliminates Palmer Lake and Tennessee Pass peaks and makes it possible to use the 6-mile single-track Moffat tunnel for transcontinental service.

The major contract items included 3,200,000 cubic yards of excavation and borrow in solid rock and mixed materials; 13,000,000 station yards of overhaul, 45,000 cubic yards of riprap, 17,000 linear feet of 24 to 72-inch corrugated metal pipe culverts, 1,344 linear feet of treated timber trestle, 10,000 cubic yards of concrete in bridges and tunnel linings, and 3,400 feet of tunnels. The railroad supplied the 1,800,000 pounds of structural steel for seven steel girder and concrete bridges and the rail and 8-inch raised ballast.

Favored by an unusually mild winter during 1932-33, the job progressed rapidly. Grading was completed in November, 1933. A Link-Belt heavy-duty 2½-cubic yard K-55 diesel shovel and another Link-Belt heavy-duty 1¾-yard K-48 gas shovel were among the shovels operated by the various subcontractors on grading.

L. S. Corey, of The Utah Construction Co., was President of the Utah-Bechtel-Morrison, Inc.; H. W. Morrison, of Morrison-Knudson Co., was Vice-President; S. D. Bechtel, of W. A. Bechtel Co., Secretary; and K. K. Bechtel, Treasurer. The field force was in charge of M. G. Kennedy, General Superintendent, with whom were associated E. B. Coulson as Contractor's Engineer and W. M. Nosman Office Manager and Purchasing Agent.

The front cover of this issue of CONTRACTORS AND ENGINEERS MONTHLY shows one of the Link-Belt power shovels at work on the Dotsero cut-off.

Replacing an Old Tar Macadam Road *with* Penetration Macadam

C & R Construction Co.'s Contract Between Oxford and Webster, Mass. Also Removed Old Underpass Hazard

A 3½-MILE tar macadam road 15 feet wide between Oxford and Webster, south of Worcester, Mass., was widened to 30 feet by the C & R Construction Co. of Roslindale, Mass., as part of the 1933 construction program of the Department of Public Works of Massachusetts. The most effective piece of work as regards the safety of traffic on this contract was the removal of an old 20-foot underpass at a crossing of the New York, New Haven & Hartford Railroad which ran at an angle to the center line of the road. This narrow underpass was a constant cause of serious and even fatal accidents, although the abutments were painted with diagonal alternate black and white stripes as a warning to motorists. The new span, which is skewed to the railroad and the abutments of which run parallel to the center line of the highway, is 80 feet long.

In preparing for the construction of this skew span and in widening the underpass, a temporary pile trestle was built from the back of the old east abutment to a point behind the new east abutment. This was a 7-bay trestle, carrying the caps and stringers. Following the completion of the trestle, the old railroad fill was then excavated with no train interruptions and only a slow board. The new west abutment is merely the old abutment with a heavy facing of concrete to match the new east abutment.

On the west abutment and wing walls, the contractor drove steel sheet piling at the neat line of the old and new footings, enclosing the entire new footing. The footing excavation was carried 4 feet below the old footing and was excavated and poured in alternate sections from 5 to 10 feet long to eliminate any danger of undermining the existing structure, as the borings and the first excavation showed considerable fine sand and water in the locality.

The only other important structure on this contract was the Taft Brook Bridge with an 18-foot span, 50 feet wide between curbs. It consists of a 22-inch rein-

forced concrete slab and gravity walls. The concrete was mixed in a Rex 14-S mixer with four men alternately shoveling and wheeling two wheelbarrows with stone and two men hand loading and wheeling the two sand wheelbarrows. The concrete was delivered by chute from the mixer to the footing and walls. An interesting construction problem arose in connection with this bridge, which had to be located on the old site because the center line of the Taft Brook Channel determined the division of adjacent property and the owners objected to any alteration in the channel. The contractor, therefore, dug a diversion channel entirely around the bridge and later backfilled it when the structure was complete. Water from the Oxford Town mains was used for mixing the concrete and the excavation was drained by a Domestic pump.

EXCAVATION AND GRADING

The contractor started early in April, 1933, to grade this contract, beginning at the south, or Webster, end because the larger cuts were located in that section. The 3,000 yards of ledge excavation was drilled with a 300-cubic foot Ingersoll-Rand compressor, using three and two jack hammers. The rock was stratified on a slope, making drilling difficult and it was necessary to use only shallow holes which increased the cost of rock removal. The largest cut in dirt excavation, 19 feet deep, was 12,000 cubic yards and the 3,000 yards of ledge excavation was located in this same cut.

Excavation was handled with two Lorain 75-B 1¼-yard gas shovels, one 1-yard Byers gas shovel and one 1¼-yard Byers gas shovel. There was a pit man with each shovel and on the largest fill eight men were used as hand laborers to spread the filling material. A Caterpillar Thirty with a bulldozer was used for handling large boulders and rocks which the men could not manage alone. The contractor operated three hired trucks per shovel, with the average haul about 500 feet and the maximum 1,000 feet. As this contract was run under the 30-hour Federal regulations, the contractor worked a 60-hour week with 10-hour days, changing his shifts on Thursday of each week. Each truck was worked the 60-hour week with two drivers.

In order to give as much employment as possible, the grade was entirely hand trimmed and the contractor used three men per truck on the dump. All of the fills were rolled by hauling over them in spreading in 1-foot layers and then each layer finally compacted with two Buffalo-Springfield 12-ton gas rollers.

A 12-inch gravel subbase was spread the entire length of the contract, except in wet cuts where an 8-inch stone fill was spread and compacted over a 4-inch gravel cushion. The gravel subbase was rolled in two 6-inch layers with 12 and 14-ton rollers after initial compaction by the trucks hauling over it.

SPREADING AND FILLING THE BASE COURSE

The 4½-inch base course of stone composed of ¾-inch to 2¾-inch crushed stone was spread in one layer and rolled. Over the stone fill in the wet cuts, this base course was only 2 inches thick. The stone was supplied by the J. S. Lane & Son Co. quarry at Westfield, Mass., and delivered by rail to Oxford or Webster, whichever was more convenient, hauled in three trucks and spread on the road from the tail-gates which were regulated by the truck drivers from the cab. A labor crew of seven men with forks and rakes uniformly spread the bottom course under the direction of a foreman.

Another crew of four men hand cast the sand binder over the base course after it was rolled, using sand from stockpiles previously placed along the shoulders. During the rolling of the base course and sand binder, the same four men who had hand cast the sand binder broomed it to give a uniform distribution of the sand.

THE SURFACE COURSE AND PENETRATION

The top course was 2½ inches thick and composed entirely of stone from 2½ to 1¼ inches screen size. This was spread in the same manner as the base course but with a different labor crew of six men and a foreman.

Two "spotters" trued up both the base and top by eye, as this was done under the 1932 specifications. The Massachusetts 1933 specifications required use of a 20-foot straight-edge. These "spotters" used lines at the 50-foot stakes and sighting from these, with their eye close to the surface, prepared a remarkably even and true grade. This was done both before and after rolling both the base and top courses.

Colonial Beacon asphalt, 85-100 penetration, furnished and applied by the Eastern Asphalt & Oil Co., was used on this job. The asphalt was applied at the rate of 2⅛ gallons per square yard at 350 degrees Fahrenheit in the penetration course by a Kinney distributor. The penetration was rolled as soon as possible after application with the rolls of the 12-ton gas roller wet down to prevent adherence of the asphalt to the rolls. By rolling immediately after penetration, the surface course was smoothed and bound uniformly.

While the surface was still sticky, which in the hottest weather might be as much as five days after penetration, but usually within 36 hours, the surface was covered with ½-inch stone by hand casting. No traffic was allowed over the road and the stone was broomed by four men to give it uniform distribution and then rolled after brooming.

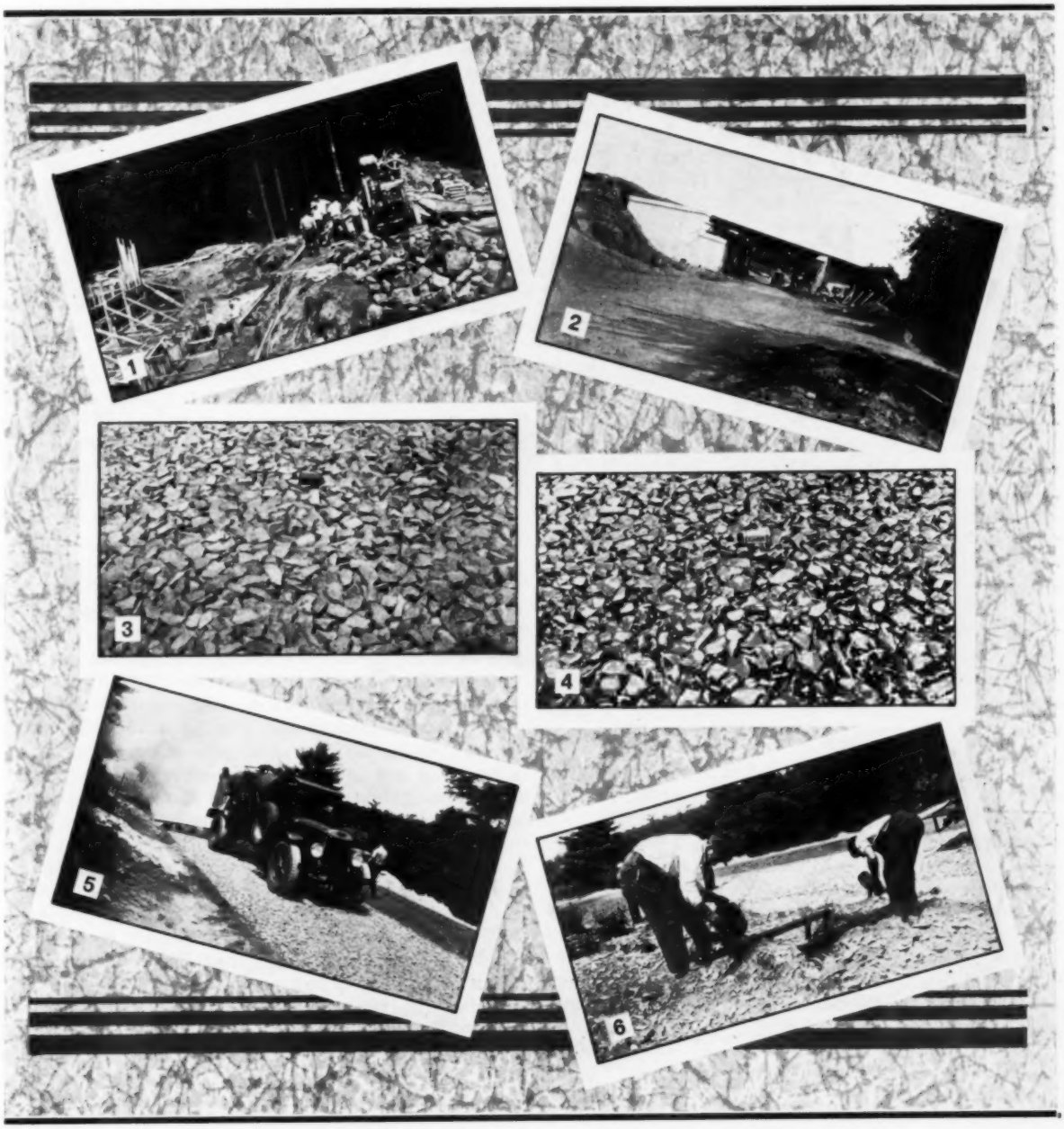
Long stretches of the penetration macadam were sealed at one time, using ⅜-gallon per square yard of the same 85-100 penetration asphalt as used for the penetration course. This penetration is specified for all asphalt applied between May and October. Immediately after sealing, a crew of twelve men hand cast ½-inch stone over the surface from stockpiles along the road. This stone was broomed and rolled until a homogenous surface was secured.

Two different methods were used in starting and stopping the penetration to prevent a fat or lean strip as is frequently found where great care is not taken to secure a uniform distribution of the asphalt over the entire surface. At first a 1-foot gap was left between the last strip of road penetrated, this strip being poured by hand later. Also on the seal coat the initial practice was to lay a 36-inch roll of paper across the end of the strip previously sealed, cover the paper with sand, to prevent the asphalt running off the paper, and then run the truck distributor over it and start the nozzles when they were at about the middle of the paper strip. This was abandoned as the pressure of the truck wheels frequently caused the paper to stick to the roadway so

that when the paper was to be lifted off it would tear and all of the sand and asphalt would be dumped on the road, causing fat spots. The later method used on penetration was to lap the application of asphalt about 1½ feet. At the end of the rock when the tank was practically empty, this 1½-foot strip would be lean. In continuing penetration the asphalt would be started just before the end of the previously penetrated strip was reached and then at the end of the strip, the pump was thrown in, applying the asphalt at a pressure of about 60 pounds. On the seal coat the paper was dispensed with and the skill of the operator relied upon to hit the section accurately as the truck drove along at a speed of about 6 miles per hour.

On this contract the contractor ran the bottom course, sand binder, top course and penetration along together and averaged 500 tons of stone spread and rolled per 10-hour day with a maximum of 650 tons in one day. All local labor was used, with a minimum wage of 45

(Continued on page 38)



BRIDGE WORK AND PENETRATION PAVING SOUTH OF WORCESTER, MASS.

1. *Pouring the south footing of the Taft Brook Bridge.* 2. *Removing the old 20-foot underpass and preparing the abutments for the new 80-foot skew-railroad bridge.* 3. *The top stone rolled, showing the texture before penetration.* 4. *The same section after penetration and rolling but before hand casting the ½-inch stone.* 5. *Applying the penetration asphalt at the rate of 2⅛ gallons per square yard. The three outer nozzles on the distributor arm were plugged to prevent spreading the asphalt beyond the edge of the stone.* 6. *Cleaning the nozzles after emptying the tank.*

Two Mixers *on* Concrete Base *for* Brick Pavement

LAST summer a section of the Cleveland-Akron road, Ohio Route 8, was paved in Shaker Heights and through North Randall Village, two suburbs of Cleveland, Ohio, south east of that city. The section was 2.75 miles long and had two 20-foot pavements with a 35-foot boulevard plot between. As with all projects in which the Federal government had a financial interest, it was manned with welfare labor and remarkable progress was made. The contractor, the Cleveland Trinidad Paving Co., let the rough grading to J. W. Harris of Bedford, Ohio, and the sewer and drainage work under other subcontracts to Albert Joseph, L. Lucarelli and Colonial Construction Co. John Sieworek had the subcontract for laying the brick course.

Rough Grading

The grading contractor used two complete outfits, both with elevating graders but one with mules and the other with trucks for hauling away the material. The first was a Stroud elevating grader with a 42-inch belt pulled by a Cletrac 100 and delivering the dirt to seven wagons with 3-up mule teams. The average haul with this outfit was about 300 feet and it moved about 750 cubic yards a day. The second outfit was a Caterpillar elevating grader with a 42-inch belt, pulled by a Cletrac 100 and delivering the dirt to a fleet of seven trucks which hauled the material as much as 3 or 4 miles for fill.

The grading crews worked five hours a day, six days a week, with two complete labor outfits.

Sewer Construction

There were 2.5 miles of sewer installed in the boulevard area ahead of paving. Universal concrete pipe ranging from 24 to 42 inches in diameter was used in trenches 4½ to 16 feet deep and 4 feet wide all excavated by hand. As the material was generally clay, sheeting was not necessary, but for a distance of 600 feet the trench ran through water-bearing gravel and it was necessary to drive wood sheeting. The sewer contractor, Albert Joseph, used hand labor crews of thirty men each for excavating and for lowering the pipe into the trench. No crane was permitted but a small hand derrick straddling the trench handled the pipe very satisfactorily.

Other Engineering Details

The financing of this work was a bit complicated. The Federal government paid for the westerly 20-foot strip including the grading, concrete foundation for the brick and the brick top only. The entire sewer, all the curbing and all the work on the east side were paid for by the county. Instead of calling for an integral curb poured with the paving or even poured later, the plans called for a 6 x 24-inch sandstone curb except where there were sharp curves and then granite radius curb was used. This complicated the finishing of the concrete considerably as the finishing machine worked 9¾ inches below the elevation of the tops of the curbs and had to leave a strip about a foot wide on either side to be finished by hand tamping.

The pavement as built up consisted of the grade with 4 inches of granulated slag, then 9 inches of uniform thickness concrete slab as foundation for a 3-inch brick top with a ¾-inch granulated slag cushion. All curves were superelevated.

On some sections where the elevating grader would not be economical for grading the section, the contractor put in a Lorain 75 which loaded to hired trucks. This merely supplemented the grading which was done by the subcontractor.

Form Setting and Fine Grading

As there were no forms used, it seems a bit out of order to talk about form setting but the sandstone

Edgestones in Place of Forms Made Federal-State-County Job Unusual in Finishing

curbs were really the forms for the concrete and also for the finishing machine to run on. Twenty-four setters, aligners and cutters made up the group that placed and fitted the curb slabs. Ahead of these men were twenty men digging the trench for the 4-inch vitrified tile bell and spigot drainage line, which was set 40 inches from the top of the curb to the flow line of the tile.

The slabs of sandstone were brought to the site by a flat bed truck and unloaded at approximately the location needed and then handled entirely by the setting crew by hand. The setting and aligning of the curb was immediately followed by the fine grade crew of seven men and a foreman. They used a scratch-board similar to the one described below used by the slag crew. Trucks with the granulated slag backed onto the grade at points about 200 feet apart where the curb had been omitted for this purpose, and dumped the slag on the grade. It was spread by hand and checked with a scratch-board which had rods or "pegs" every foot and 2½ feet long to reach from the top of the curb on which the board was dragged down to the grade. The roller equipment between the forms and ahead consisted of a 10-ton Buffalo-Springfield steam roller on the rough grade and a Huber 6-ton gas roller on the fine grade.

The slag crew consisted of eleven men. The slag was hauled a distance of 11 miles. The final fine grade was completed by ten men with a drag template similar to the subgrade planer used with pavers. This cut the grade accurately to 9 inches below the top of the finished concrete slab. It was pulled over the slag until no slag was picked up. The slag was luted by one of the men to take care of any uneven spots by moving the fine slag from high to low places. A hand roller was used as the final operation.

Joints and Reinforcing

As the pavers ran on the boulevard strip between the concrete slabs the fine grade and slag was not disturbed after completion. This made it possible to place all the reinforcing within the area to be paved and thus saved much congestion behind the paver. The two pavers worked on the same area, that is, the first, a Ransome 27-E paver, poured the lower concrete on which the reinforcing fabric was laid and the second paver, a 27-E MultiFoote, with its boom headed toward the first paver, poured the top concrete over the reinforcing. As there was a much greater volume of concrete required beneath the steel, the second paver frequently poured concrete for the lower course. With the two pavers working, each requiring batch trucks to supply them, there was great need that the boulevard strip be in good condition for hauling. Throughout the work, a Galion 10-foot power grader worked as a maintainer for the temporary roadway for the use of the batch trucks.

Contraction joints were placed every 50 feet in the slab consisting of six ¾-inch round bars 4 feet long with 2-foot metal sleeves placed on the side away from the paver and set with wire chairs. They were placed at mid depth of the slab. Above these the transverse joints were cut as described later. The Wheeling corrugated reinforcing mesh was laid on the grade ahead of the paving merely for storage and then was carried forward as needed and placed on the concrete. This kept the wire off the shoulder where it is so liable to be bent and rendered unusable.

Deformed bars ½-inch diameter and 5 feet long spaced 5 feet apart and set on wire chairs were placed across the center joint to tie the two sections of the slab together after the center joint had been cut in the poured slab and the pavement had set. Extra reinforcing was placed over all drainage connections across the pavement. Reinforcing bars 7 feet long and ⅝-inch diameter, all wired in mats, were used.

Pouring the 20-Foot Slab

The two pavers, as mentioned before, poured toward each other, thus being able to assist in keeping the top and lower courses even. The Ransome paver had a 28-foot boom and the MultiFoote a 21-foot boom, so the Ransome was used for pouring the 7 inches of lower course as its reach was greater. The top 2 inches and some of the base was poured by the other paver. Water for the pavers was secured from fire hydrants along the right-of-way, through a 3-inch pipe line and a 2-inch hose which connected to the Ransome. Then through a tee and 50 feet of hose the water was carried to the MultiFoote.

As the grade was in practically perfect condition ahead of pouring, there was no subgrade planer at the paver nor were there any final grade men there. Each paver had its operator who greased and oiled it in spare moments. The steel men as mentioned placed the reinforcing mesh on the grade and the puddlers went back and picked it up to place on the concrete as needed. There were six puddlers, due to the amount of concrete poured by the two pavers. The steel men also placed the dowel bars and all other reinforcing in the slab.

There was one man at each paver to dump the three and four-batch trucks as they backed to the skips. A Lakewood finishing machine worked on 3 x 4 x ⅝-inch angle irons laid on the tops of the sandstone curbs with the 4-inch leg on top. These were held in place by strap iron welded to the angles and punched for pins which were driven into the grade outside the curbs. The single screed finisher carried the cutter wheel for the center joint which was set from an 8-wheel bridge by three men. A unique device was used for setting the transverse joints. The center joints were set with 6-foot steel strips tapped into place with a wooden mallet

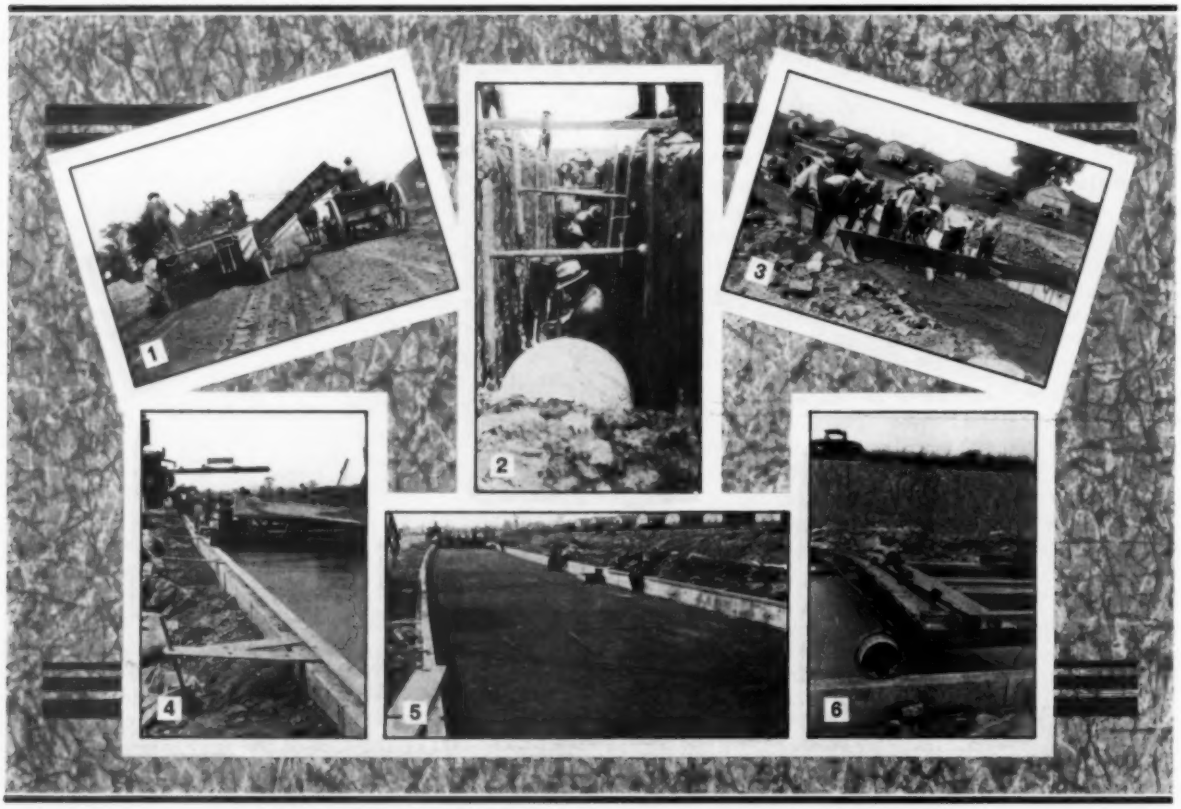
as the slot had already been cut by the wheel on the finisher. The joints were 3½ inches deep. On the contraction joints which were also 3½ inches deep it was necessary to tamp the steel strips into place as no cut had previously been made. This was done with two 10-foot strips with three screw couplings welded to them at the quarter points and into which was screwed 3-inch pipe containing tampers with a handle so that the blow was always effectively delivered to the strip. There were a number of these strips on the job so that they were left in the concrete after the tampers had been unscrewed and laid on the bridge.

Along the curbs where the finishing machine could not work because its screed would strike and mar the curb, two men hand-tamped a strip about 1 foot wide on each side and hand-finished it. These were extra men not connected with the regular finishers. The next operation that is unusual but very necessary on a job of this type was the realigning of the curb. On most jobs the forms are stripped but on this the sandstone curbs which were used as forms were left in place as a part of the permanent pavement. Two men realigned these curbs before the concrete set and before the finishers started their work. The three center strip men not only set and removed the steel strips but they also edged the slots. These were poured with asphalt filler F-1 after complete curing.

The hand finishing was done by one man with a 10-foot straight-edge. It was remarkable how uniform and fine the pavement looked and how quickly the excellent finish was secured. A uniform texture was obtained by dragging a piece of full-width wet burlap over the concrete after the final floating. And this for a base for a brick pavement instead of for a complete concrete slab. The burlap for curing initially was spread by two men and was sprinkled both before and after placing. It was removed about five the following morning by two men while the inspector for the state ran the bumpometer. Immediately the straw was spread by four men and wet down by one. This was always completed by 10 o'clock each morning. Also there were men who did nothing but sprinkle straw for seven days, at which time the straw was removed.

As the brick had not been delivered to the job at the time it was visited, it is impossible to report the methods used in spreading the sand cushion and dropping the brick. It is known, however, that the brick used was of the new 3-inch type with lugs on both the side and ends and that they were protected from the undesirable adhering of asphalt to the top surface by spraying with a special solution. The asphalt for the joints was poured on with a bucket rather thick and allowed to run into the joints, leaving as much as ¼ inch of the

(Continued on page 38)



PREPARATION OF GRADE AND FINISHING THE CONCRETE BASE

1. The 42-inch belt elevating grader loading mule-drawn dump wagons, handling 750 cubic yards a day. 2. Hand labor for the trench for a section of 36-inch concrete sewer. 3. Bringing the granulated slag to final grade by hand and checking with a scratch-board, having 2½-foot teeth. 4. The method of supporting the angle irons on the tops of the sandstone curbs to prevent damage by the finishing machine. 5. As the paver ran on the boulevard strip between the two pavements, all of the reinforcing was placed on the grade well ahead of pouring concrete. 6. The device for cutting the slot for the 3½-inch contraction joint, laid out on the rolling bridge.

The Lubrication *of* Road Rollers *and of* Steam-Operated Equipment

The Eighth of a Series of Articles on an Important Phase of the Maintenance of Construction Equipment

EACH problem of lubrication has conditions peculiarly its own and the ideal solution of the problem would be to have a special lubricant for each type of bearing used in each piece of equipment. But this is impracticable so the science of lubrication becomes the selection of the available oil which will obtain the most economical and efficient results for the purposes required.

The refiner's line of oils is limited to the type or types of crude, and the facilities he has at his command. From these he determines the types of lubricating oils he will produce, to meet the requirements of his particular trade and frequently specializes in that particular line. With the rapid advancement of the science of lubrication, many engineers have developed special specifications for their lubricants to meet their particular requirements, which necessitates the blending of different oils and not infrequently demands that they be compounded with various animal and vegetable oils. This practice has become so common that there is a great variety of blends and compounds, which are used with a greater or lesser degree of success for identical purposes.

Road Rollers Require Special Care in Lubrication

Road rollers are of necessity large, cumbersome and heavy. They are sturdily built to withstand the rigorous duty they are required to perform, but very often are operated in a manner contrary to the instructions of the manufacturer, by running the roller at comparatively high speeds and stopping suddenly, as well as reversing the engine too quickly, thus causing an excessive strain on all bearing parts. Therefore, they should have the fullest protection by frequent attention to their lubrication. The modern motor-driven roller of the three-wheel type, and of average size, has approximately 70 points of lubrication, exclusive of the internal bearings of the engine.

Care should be taken in the selection of the proper lubricants for use in the bearings of road rollers, as in many instances the bearings are comparatively small and carry heavy loads, which require a grade of lubricant which will not break down readily under pressure. Most of the various makes of rollers are equipped with the Zerk-Alemite pressure fittings, which necessitates the use of grease lubricants of a consistency which may be applied readily with the dispensing equipment furnished for that purpose. This density or consistency is comparatively light and, therefore, they should be made with a viscous oil combining the best base materials obtainable, and manufactured with the greatest care, to insure the maximum of pressure-resisting properties.

Many bearings are more or less inaccessible and for that reason there is an inclination to neglect them from time to time, though they may require lubrication daily or twice a week. For instance, the clutch pilot bearing requires the removal of the cover from the clutch housing, which requires more or less time, but it is essential that this bearing be lubricated well at least twice a week; the forward and reverse clutch thrust bearings should also be lubricated twice a week; the clutch throwout collar should be lubricated daily. There are other bearings requiring as frequent attention, which are also more or less inaccessible. It is excellent practice to lubricate all bearings thoroughly at least once a week, notwithstanding the fact that certain instruction books may designate one month intervals for the lubri-

Modern Gasoline-Powered Road Rollers Require Pressure-Resisting Lubricants

cation of certain bearings. The additional time required for this work is inconsequential as compared to the benefits to be derived through the elimination of bearing troubles and prolonged life of the bearings. This is particularly true when the roller is operating under dusty or dirty conditions, as the additional lubricant keeps the outer ends of the bearings sealed against the entrance of dust, dirt and other abrasive substances.

As no bearings are subjected to extreme high temperatures, a calcium-base lubricant should be used as it is not subject to emulsification when in contact with water, as is the sodium-type grease, which is an important factor considering that road rollers are exposed to all kinds of weather.

In connection with the lubrication of transmission and rear axles of motor-driven road rollers, the same recommendations are made as for other motor-propelled equipment. For the most efficient and economical lubrication of these gears, an extreme-pressure or lead-base lubricant should be used of a consistency equal to S.A.E. No. 160. As the weight of road rollers range from 5 to 20 tons, the duty imposed on the gears is excessive, but the additional stress caused by sudden stops and reversal of the engine increases the load considerably, and the lubricants mentioned absorb this pressure most satisfactorily without breaking down. Ordinary gear lubricants may accomplish the purpose desired but, with their tendency to break down under heavy loads, necessitate more frequent changing, and the additional quantity consumed more than offsets the difference in first costs, without consideration of the superior lubricating properties. The gear cases should be filled to the filler plug level, an inspection made weekly and the lubricant replenished as required.

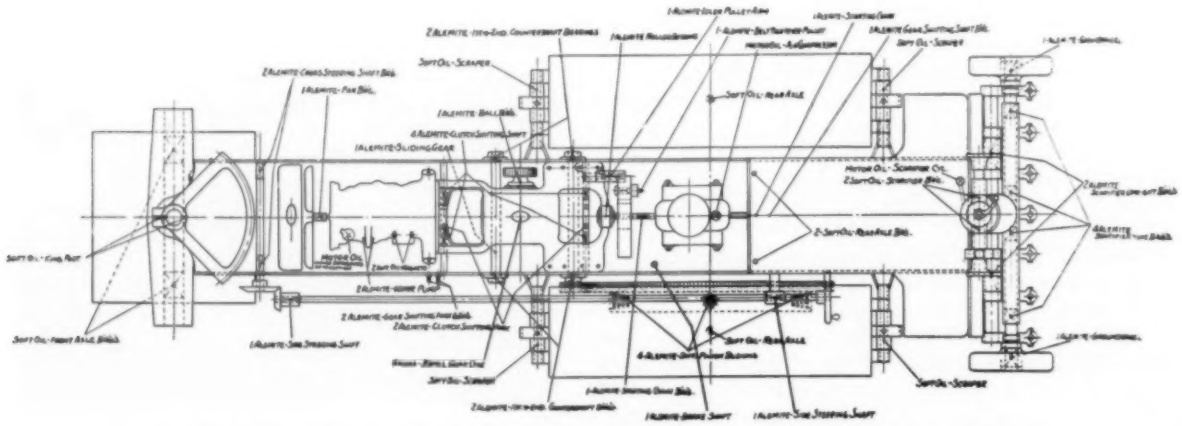
Steam-propelled road rollers differ in construction from the motor-driven machines, inasmuch as their power is transmitted from the steam cylinders through driving rods, eccentrics, guides, etc. These invariably are lubricated through the medium of grease cups, though some are dependent upon and equipped for the use of oil. Where grease cups are installed a good grade of cup grease of about a No. 3 consistency should be used. Where these bearings are equipped with oil cups, a good grade of engine oil should be used. This oil should possess a good body but not so viscous as to retard the feed through the orifice of the stem of the cup. Still other units of this type have force-feed or splash systems of lubrication and the same grade of engine oil as mentioned above should be used.

STEAM ENGINES PRESENT SPECIAL LUBRICATION PROBLEMS

The proper and satisfactory lubrication of the valves and cylinders of steam engines offers one of the most difficult problems met with in practical lubrication. Steam cylinder lubricants must perform their work under most unsatisfactory conditions and in an inaccessible place, where the detection of poor lubrication is difficult. The cylinder lubricant must be atomized by the incoming steam and carried to the cylinder walls, the surfaces of which are wet and under high temperature, resulting in a most unfavorable condition. There is a tendency to destroy the lubricating film through the washing effect of the water as well as the action of the piston and valves.

Steam having a temperature due only to its pressure is designated as "saturated steam." Steam which has been heated to a higher temperature than that due to its pressure alone is called "superheated steam." The pressure of the steam supplied to a steam cylinder is an important guide in the selection of a lubricant for that cylinder. By reference to standard steam tables, the temperature of the steam may be directly determined if the steam is "saturated," and may be obtained by adding the number of "degrees superheat" if the steam is superheated.

Saturated steam, at a gage pressure of 250 pounds per square inch, carries a temperature of but approximately 405 degrees F. Therefore, in selecting an oil, it is not necessary to give consideration to the flash and fire tests of the oil, as any steam cylinder oil will have a flash test in excess of this temperature. For saturated or wet steam, the oil should be compounded to aid the emulsification of the cylinder oil with the condensed steam. Acidless tallow oil is considered the best emulsifying agent and is generally used by the manufacturer of the best grades of steam cylinder oils. Inferior oils are generally compounded with degras, which is obtained from the wool of sheep, and such compounded oils should not be used. Neatsfoot oil and lard oil are also used for this purpose, but are not considered as efficient as acidless tallow oil. The percentages of



The Lubrication Chart for a Standard 4-Cylinder, 3-Wheel Buffalo-Springfield Motor Road Roller

tallow oil used for compounding purposes should range from 3 per cent for ordinary dry saturated steam conditions to 8 or 10 per cent for low pressures and unusually wet steam, where the percentage of moisture will be unusually high.

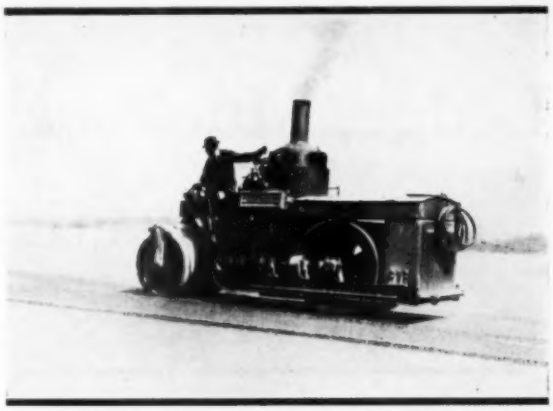
Superheated steam has a temperature range as high as 600 degrees F. and contains little or no moisture. Owing to the absence of moisture and the high temperatures it acquires, an uncompounded, straight mineral oil should be used, which has a high viscosity and flash-point. Low viscosity oils could be used, but the consumption would be excessive and increase the formation of deposits in the cylinder. If the temperature of the steam is not in excess of 550 degrees F., an oil having a viscosity of 200 to 250 at 212 degrees F., and a flash ranging from 570 to 590 may be used. For higher temperatures the viscosities should be from 320 to 350 at 212 degrees F., and the flash-point from 605 to 625 degrees F.

At stated periods the cylinders should be examined to determine whether or not they are receiving proper lubrication. When the cylinder head is removed, the walls should appear dark and smooth, with no signs of bright spots or a brightly polished surface. Many engineers believe that if the walls appear to be highly polished, it is an indication of good lubrication. On the contrary, it is proof of high frictional wear. Rubbing the wall lightly with a cloth or piece of soft paper should disclose a bright polished surface, in contrast with the dark surfaces of the remaining portion of the walls.

Frequently trouble is experienced with cylinder deposits which the engineer attributes to a poor or improperly selected cylinder oil when the actual cause of the trouble may be traced to a clogged trap or pipe. Invariably the analysis of deposits from steam cylinders will show the presence of iron. This may be due to the piston rings having been set too tight and they have scraped into the soft iron of the cylinder, these iron scrapings combining with the oil to form a heavy deposit. Another cause of the formation of such deposits is the carrying over of foreign substances, such as silica, iron oxide, carbon, etc., by the steam from the boiler. Therefore, the presence of iron in such deposits does not necessarily indicate metallic wear, due to using a poor lubricant.

Very often a complaint from an engineer regarding his cylinder oil may be traced to the excessive use of boiler compounds. These consist generally of caustic soda, soda-ash, potash, or other chemicals of a similar nature, which have a very detrimental and destructive effect upon cylinder lubrication when they are carried over by the steam to the cylinders, as they tend to thicken the oil to an appreciable extent.

These suggestions for lubrication apply to steam engines in all types of construction equipment, including steam rollers, steam hoists, steam shovels, stationary engines of all types, etc. In selecting the type or character of oil to be used for the lubrication of the steam cylinders, the following conditions should be considered: the kind of engine; the condition of steam, wet or dry, or superheated; the steam pressure; the rubbing speed of the piston; the method of feeding to the cylinder; the diameter of the cylinder; the distance the steam has to be carried from the boiler and the covering of the steam line.



A Good Roads Steam Roller Working on Penetration Macadam Base. This Type of Work, Requiring Constant Starting, Stopping and Reversing, Puts the Roller Under Considerable Strain Which Must Be Offset by Proper Lubrication.

THE LUBRICATION OF STEAM HOISTS

Steam hoists are manufactured in various types to meet the demands of the specific duty they are required to perform and it would be impracticable to treat each type separately from the standpoint of lubrication requirements. There is a similarity between the various types as far as the construction of reciprocating parts, gearing, etc., is concerned. The medium by which the lubricant may be applied is by hand or spring automatic compression grease cups, or through pressure fittings of the Zerk-Alemite type. The exceptions are those types which are designed for oil lubrication. These are either equipped with oil cups or are lubricated with a splash or force-feed system.

Hoists operate at variable speeds and under changing loads, frequently handling loads beyond their rated capacity. Like many other units of contractor's equipment, it is essential that care be exercised in selecting lubricants to be used, as a safeguard against trouble when operating under the severest conditions. When a grease lubricant is used, it is necessary that it possess a comparatively high melting point to meet the requirement of crank-pins, eccentrics, connecting rods, guides, etc. A lubricant which is satisfactory for these bearings should work admirably well on main bearings, reversing links, operating shafts, etc. If the lubricant is to be fed to the bearings through grease cups, it should be a well-made grease of a good No. 3 density. If equipped with pressure fittings, the lubricant should be made with a viscous oil and be of a No. 2½ consistency. It is essential that it be free of acids, which would have a tendency to pit the bearings.

All open gears and pinions should be lubricated with a heavy-bodied, adhesive gear grease which will stick to the teeth when under load and not be rubbed off through the sliding action of the teeth of the gears when in operation. Some gear lubricants of this character are made with pine tar or asphaltum pitch, but invariably these are unsatisfactory as they materially increase the friction load, are difficult to apply at the lower temperatures and possess poor lubricating properties.

Ledge, Muck *and* Rain *on* Connecticut Paving Contract

"Stormy Weather" Not a Popular Song with D. Arrigoni on 31,600-Foot Concrete Job

WHEN a contractor has a 150-day contract with a $100 a day penalty time charge, he organizes his work very carefully so as not to be left "holding the bag" when his 150 working days come to an end. D. Arrigoni, paving contractor of Middletown, Conn., who was awarded the 31,600-foot grading and concrete paving contract on Connecticut State Route 67, between Oxford and Seymour, received the contract on December 28, 1932, and started clearing and grubbing on January 16, 1933, immediately following this by work on the rough grade. He little realized, however, that about one-third of the total time he spent on this contract would be lost through rain, and it was necessary to shut down the job completely from February 9 to March 16, 1933, because of continuous sleet, snow and rain storms.

About 50 per cent of the contract was on new location, requiring an unusual amount of clearing and grubbing for a contract in an industrial state.

Ledge and Boulders

The 46,500 cubic yards of rock excavation on this job was scattered through ledge in five major cuts. Most of the ledges were composed of low-grade granite with 3 to 5 feet of cover which was about 75 per cent boulders. One of the ledges, which was 22 feet high and about 1,000 feet long, had to be blasted out with considerable care as a high tension electric line was located across the road only 60 feet away and a telephone line about 50 feet away. On one blast ten cases of Atlas 40 per cent dynamite were used and there was no damage to a house about 50 feet away from the face of the ledge. More than usual care was exercised throughout the blasting and the contractor was required to cover only two of the blasts with mats.

Two Ingersoll-Rand 10 x 8 compressors of 330 cubic feet capacity, mounted on 5-ton trucks which carried the hose and the jack hammers along with them, were most effective in handling the drilling. Other I-R portable compressors were used to handle the drifters which drilled holes up to 32 feet long. The 1¼-inch steel used with jack hammers reached a maximum of 26 feet on the highest ledges.

The contractor maintained a shop near the middle of the job just off the right-of-way with a forge, a welding outfit and an Ingersoll-Rand oil furnace and pneumatic sharpener for the drill steel.

The broken rock and other excavation was handled by a Bucyrus-Erie 1½-yard steam shovel, a Bucyrus-Erie 1¼-yard steam shovel and a Bucyrus-Erie 1-yard steam shovel with from three to nine hired trucks per shovel hauling to the fills.

A muck hole about 1,000 feet long near the north end of the job was excavated with the 1-yard steam shovel to a depth of 2 to 4½ feet and then backfilled with broken stone from a nearby ledge and topped off with 1 foot of gravel. This fill showed no signs of settlement up to the time of completion of the paving.

Drainage Structures

The drainage structures on this contract consisted chiefly of 16 to 36-inch reinforced concrete pipe with some 3,000 feet of vitrified tile under-drain and also eight small concrete bridges. All of the bridges were hand-rubbed to secure a smooth neat finish and the quality of the work attested to the promptness with which it was done and the skill of the artisans employed for this particular work.

When the contractor was pouring 160 yards of con-

crete in one abutment of a small bridge near the center of the job, a cloudburst occurred when about 100 yards of the concrete had been poured. Within 30 minutes, 11 feet of water washed out the temporary bridge. A new bridge was put in by 10 P.M. so that traffic could travel over this road which was required to be kept open at all times during the construction of the new pavement. At the time of this cloudburst, all of the local town roads were washed out and State Route 67 was the only one available for traffic.

Rubble drains 54 inches deep and 18 inches wide at the bottom and 36 inches wide at the top, with a 6-inch tile on the bottom, were laid along the faces of the rock cuts to prevent seepage from the rock ledge to endanger traffic on the road in winter by freezing in the gutter and flowing onto the road, leaving the pavement icy.

Following the completion of the concrete pavement, a Ransome 10-S mixer was used for pouring concrete gutter. These 6-foot gutters were poured at two sections where exceptional wash was anticipated. The gutters were 7 inches thick and were so built that at a point 5 feet from the edge of the slab the gutter was 2½ inches below the slab and from this point for a distance of 1 foot the gutter turned up 6 inches above the low point. The concrete batches were proportioned by wheelbarrows and the concrete from the mixer was carried in concrete buggies, and poured direct into the gutter which was finished by hand.

BATCHING

The batching plant was located on a spur of the Waterbury-Danbury branch of the New York, New Haven & Hartford Railroad at the Oxford Railroad Station about ½-mile beyond the north end of the job. An average of twelve to fourteen cars of aggregate were

FROM BATCHING PLANT TO SLAB ON THE D. ARRIGONI CONTRACT BETWEEN OXFORD AND SEYMOUR, CONN.

1. The batching plant set-up, showing in the foreground the flat-bed truck used for shifting the gondola cars, and just beyond it, the pump for keeping the aggregate pit dry. 2. Tossing the cement onto the batch trucks. 3. Fine grade operations with tractor-mounted bulldozer and power grader. 4. Anthony Arrigoni, Superintendent. 5. Setting the substantial road forms. 6. Setting forms on timber over a concrete bridge. 7. The five 2-inch T irons used to support the reinforcing mats during the pouring of the concrete.

unloaded each working day. The crushed stone was delivered in hopper-bottom cars from the quarries at Plainville, Conn. Both sand and stone were unloaded to pits from which the aggregate was removed by a 1-yard Hayward clamshell bucket on the 45-foot boom of a P & H 600 crane and delivered either to the stockpiles or to the Blaw-Knox 3-compartment bins. The cars were moved by two Mack trucks loaded down with rock to secure traction. One of the trucks was located at each side of the batching plant so that it was possible within the restricted space available to move the line of cars in either direction for spotting at the pits. A Carter 4-inch self-priming centrifugal pump with a Le Roi engine was used for pumping out the unloading pits. This was a frequent occurrence due to the character of the soil and the frequency of rain.

The average batch consisted of 1,385 pounds of sand, 1,862 pounds of 1½-inch stone, 465 pounds of ¾-inch stone and 7 bags of cement. After the 3 or 4-batch trucks of the Mossop Trucking Co. of Bridgeport, Conn., backed under the batching plant and secured the batches of aggregate, they drove out around a small knoll and down the track about 200 feet to the end of the spur track where the box cars of bag cement were spotted. Here two men tossed the cement in paper bag containers onto the batches after a third man had shoveled the sand to level the batch. Hand trucks were used to carry the bags in stacks of seven from various parts of the freight car to the door. The State of Connecticut furnished the cement for this contract.

The labor organization for batching consisted of two men cleaning up in the cars, the crane operator, the batch man, the three men for cement and a foreman. The maximum fleet of batch trucks consisted of seven 3-batch trucks and eight 4-batch trucks while the average was four 3-batch trucks and five 4-batch trucks.

FINE GRADING AND FORM SETTING

The actual pouring of concrete in the roadway slab started July 31, 1933. Immediately prior to this the contractor started fine grading and form setting. As certain sections of the new pavement were laid over old right-of-way, it was necessary to tear up the old macadam to secure the proper line and grade. For this purpose, a Buffalo-Springfield 12-ton gas roller with a hydraulic scarifier was used, followed by a Caterpillar Thirty and LaPlant-Choate bulldozer for spreading the heavy material. On the rough grade and also for maintaining the extra width of roadway which had not been paved, so that traffic could drive over the job at all times, the contractor maintained a Wehr motor grader on the job.

The first fine grade crew which also cut the form trench by hand consisted of five men. The contractor used 8-inch Metaforms on one side and 8-inch Blaw-Knox steel forms on the other side of the first 10-foot strip of this 20-foot pavement. A crew of three men handled all of the setting while six other men dropped and drove the pins and set up the wedges to hold up the forms firmly in place in the prepared trench.

Where the concrete slab crossed bridges, the forms were set on 4 x 4's. These timbers were braced to the side of the bridge to prevent transverse movement when the finishing machine was running over them.

The regular fine grade crew which followed up the form setters consisted of seven men with a foreman. These men used two separate scratch-boards to check the grade. One extra man was used as a water boy and he also oiled the forms after they were set. The fine grade between the forms was rolled to firmness by a Huber 5-ton gas roller. Two men remained back, lining up the forms and two others hand-tamped the base of the forms both inside and outside to insure stability.

POURING THE SLAB

The first concrete was poured in the slab on July 31 and the last on September 29, 1933. Within this time, except for bad weather, the contractor maintained a high rate of pouring, keeping close to 1,717 feet per 10-hour day for the 10-foot slab of 8-inch uniform thickness. The batch trucks drove up on the unpaved section of the road and turned in private driveways and through sections left in the forms, backing to the paver. Two men ripped open the paper bags and emptied them on the batches while the trucks were backing. They carried the paper bags to a fire off the right-of-way and burned them at once so that there was no littering of the roadside with the torn bags. The man who operated the calcium chloride unit on the Ransome 27-E paver, applying the specified weight of calcium chloride in solution to each batch, also sprinkled the grade ahead of the paver whenever it was dry. The calcium chloride was applied at the rate of three 100-pound bags for each 120 feet of slab.

One man acted as master of ceremonies in spotting the trucks, using his hands to signal the drivers rather than shouting, and he dumped each individual batch into the paver. The paver pulled five 2-inch T irons attached to a single cross channel and riding upside down on the cross or top sections. These irons supported the American Steel & Wire reinforcing mats 2 inches from the bottom of the slab.

The concreting organization consisted of three puddlers and two spaders, the latter taking care of placing the expansion joints and the steel mats. An Ord double-screed finishing machine with an operator and helper shoveling to the strike-off followed the puddlers closely. The finishing machine carried the expansion joint material.

Then four finishers followed up the Ord double-screed machine, using 4-foot and 8-foot long-handle floats made of triangular blocks 3½ inches wide and 2 inches high. A Lakewood 10-foot aluminum checking straight-edge was used to measure the accuracy of the work of the hand finishers. A novel piece of equipment developed by the Resident Engineer was then used on the slab. This was a belt made of tar paper wrapped loosely around a 2 x 4 and which was moved forward as each section of the slab was finished, using a slight transverse motion which helped take off any surface water left standing on the slab.

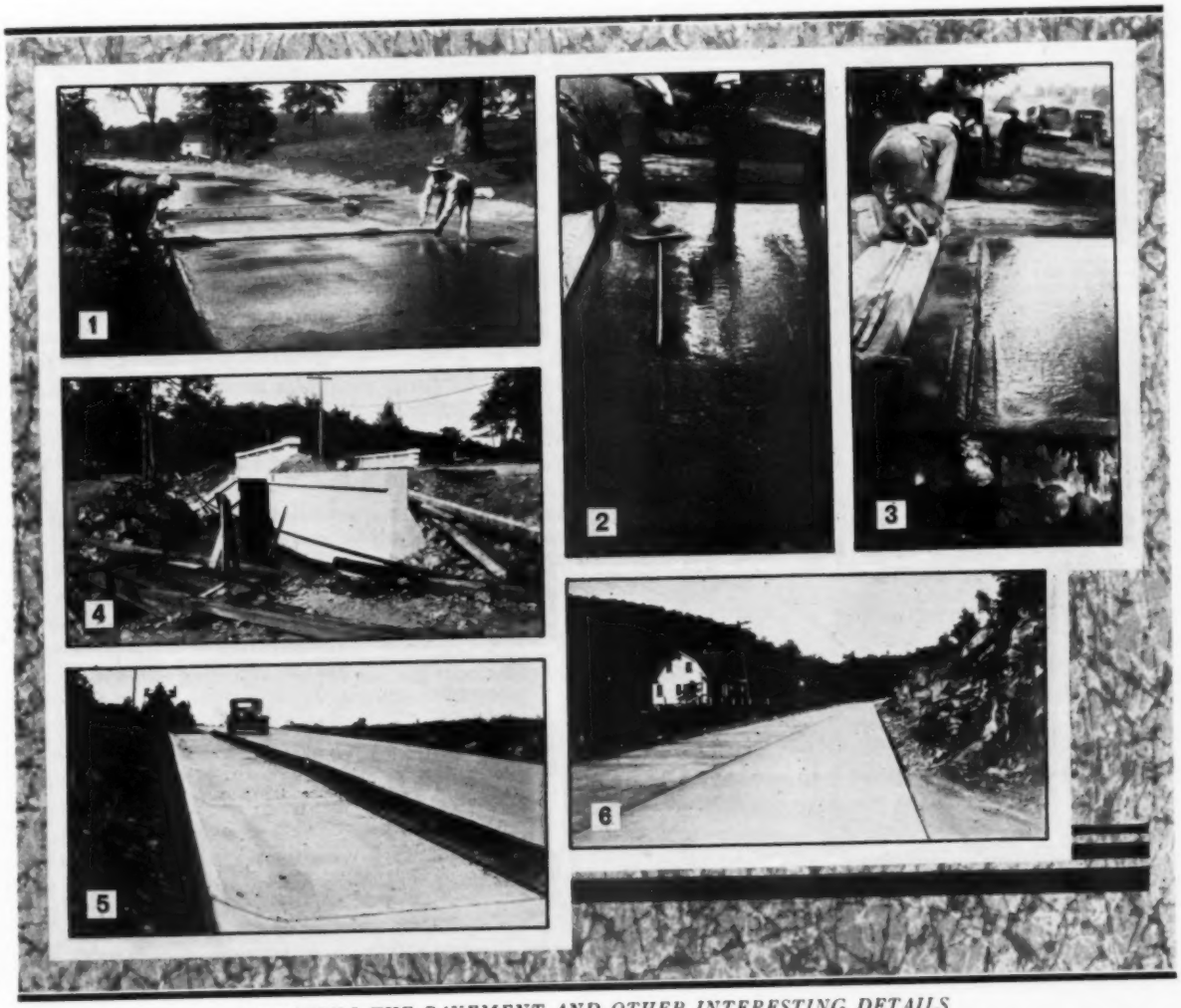
Expansion joints ½-inch wide were placed every 61 feet 4 inches in the 10-foot slab and between the slabs ¼-inch premoulded expansion joint was inserted. The expansion joints were set with equal-leg caps 1 inch deep under which a ½-inch square rod was placed on top of the premoulded expansion joint material. This acted as a guide for the hand finishers in edging the expansion joints. A steel plate was held snugly against the expansion joint material on the side toward the

paver. Four pins were driven to hold the expansion joint on the side toward the paver and none on the side of the concrete. After the expansion joints and the slab next to the forms had been edged by hand, the entire slab was given a broom finish. The top ½-inch of the expansion joints which was occupied by the square rod was poured the following day, using hand pouring pots filled from a portable Littleford asphalt kettle which was moved along the slab.

For the first two or three hours in the morning, the two men who laid out the steel mats along the shoulder ahead of the paver went back and spread the burlap immediately behind the finishers for the remainder of the day. The burlap was wet down by a Ford truck equipped with a 500-gallon tank and a Homelite pump on the back. The driver manipulated the hose from the driver's seat to soak the burlap uniformly. The tank was filled from brooks along the right-of-way and the burlap was wet for 30 hours after laying, then rolled up and carried ahead by the service trucks which also moved the forms and spotted the bags of calcium chloride along the shoulder for the paver.

WATER SUPPLY

Water for sprinkling the grade ahead of the paver and also for mixing the batches was supplied by a Barnes triplex pump located at the center of the job, pumping from a brook through a 2½-inch pipe. The taps for the paver hose were inserted every 280 feet in the line and the paver carried two lines of hose each 150 feet in length. The steel and burlap men were responsible for bringing up the second hose after it was disconnected from the paver. As the paver moved along, the hose attached to it was moved by rolling, thus preventing the rapid deterioration of the hose as is caused by dragging it over rough stones along the shoulder.



FINISHING THE PAVEMENT AND OTHER INTERESTING DETAILS

1. Using the belt made of roofing paper wrapped around a 2 x 4 to remove surface water. 2. Floating an expansion joint with the ½-inch square rod still in place, after the removal of the cap. 3. Edging the joint. 4. One of the new concrete bridges. During the pouring of the abutments, a cloudburst brought the water of this small stream up to the level of the floor. 5. One of the sections of concrete gutter poured after the completion of the pavement to prevent wash of the shoulder on the maximum grade. 6. The completed pavement before the shoulders were finished at the section where a dwelling was located 50 feet from a ledge requiring heavy blasting.

COMPLETING THE SHOULDERS

The shoulders and the final cleaning up of the job was completed November 1, 1933. Some difficulty was experienced in getting rid of the large rock along the shoulders and the rock which was brought down in dressing the slope. In many cases it was necessary to dig holes in the shoulders and bury the larger rocks.

QUANTITIES AND UNIT PRICES

Clearing and grubbing	Lump sum	$1,000.00
Earth excavation	46,130 cubic yards	0.25
Rock excavation	50,126 cubic yards	0.60
Unclassified excavation	2,276 cubic yards	0.50
Trench excavation	5,205 cubic yards	0.50
Borrow excavation	9,664 cubic yards	0.20
Formation of subgrade	75,900 square yards	0.01
Shaping slopes and shoulders	47,407 linear feet	0.01
Gravel filled subbase	31,782 cubic yards	0.40
Concrete pavement	15,285 square yards	4.10
Bar metal reinforcing	68,715 square yards	0.18
Premoulded ½-inch expansion joint	11,967 linear feet	0.07
Premoulded ¼-inch expansion joint	34,638 linear feet	0.05
Brokern stone, water bound macadam	1,991 tons	1.50
Class A concrete	1,047 cubic yards	10.00
Class B concrete	2,117 cubic yards	6.00
Class D concrete	30.13 cubic yards	40.00
Deformed steel bars	177,438 pounds	.04
Catch basins	23	35.00
15-inch reinforced concrete pipe	2,048 linear feet	.25
18-inch reinforced concrete pipe	1,768 linear feet	.35
24-inch reinforced concrete pipe	252 linear feet	.75
30-inch reinforced concrete pipe	160 linear feet	1.00
36-inch reinforced concrete pipe	176 linear feet	3.00
Vitrified tile underdrain	3,238 linear feet	1.00
Vitrified tile outlets	220 linear feet	.50
Plain concrete gutter	1,316 square yards	1.00
Concrete bridge rail	524 linear feet	5.00
Wire rope railing	20,131 linear feet	.30
Channel excavation	2,933 cubic yards	.50
Rip rap	1,546 tons	.50
Service bridges	60	10.00
Concrete wearing surface	804 square yards	.50
Type A anchorage	158	6.00
Type B anchorage	38	8.00
Temporary bridges	3	100.00
Removal of old superstructure	Lump sum	150.00
Rolled gravel	133 cubic yards	1.00
Gravel walk	544 square yards	.10
Wet excavation	1,166 cubic yards	2.00
Swamp excavation	3,951 cubic yards	.50
Extra work	Lump sum	5,041.60
Bid		$187,472.61
Total (with extras)		205,253.38

PERSONNEL

The contractor for this paving job was D. Arrigoni of Middletown, Conn., whose son Anthony Arrigoni was Superintendent. For the Connecticut State Highway Department, D. J. Linehan was Resident Engineer.

Replacing an Old Tar Macadam Road with Penetration Macadam

(*Continued from page 27*)

cents per hour for unskilled labor and 55 cents per hour for skilled labor.

QUANTITIES AND UNIT PRICES

Road earth excavation	60,000 cubic yards	$0.30
Bridge excavation	2,540 cubic yards	2.32
Ledge excavation	3,000 cubic yards	0.30
Ordinary borrow	8,000 cubic yards	0.30
Concrete head walls, 1:2½:5 mix	90 cubic yards	10.00
Reinforced concrete bridges, 1:2:4 mix	201 cubic yards	12.00
Broken stone	23,400 tons	1.95
Bituminous material	172,400 gallons	0.08
12-inch concrete pipe	2,700 linear feet	0.35
12-inch reinforced concrete pipe	1,280 linear feet	0.65
18-inch reinforced concrete pipe	356 linear feet	1.15
30-inch reinforced concrete pipe	124 linear feet	2.80
42-inch reinforced concrete pipe	172 linear feet	6.75
Stone fill in cuts	4,650 cubic yards	1.20
Catch basins	11	35.00
Gravel borrow	25,000 cubic yards	0.30
Sand borrow for binding base	1,590 cubic yards	0.60
Rubble concrete masonry 1:2:4 mix	1,198 cubic yards	6.80
Fine grading	107,000 square yards	0.01
Reinforcing steel	36,000 pounds	0.03
Clearing and grubbing	6.8 acres	30.00
Steel sheet piling	38,430 pounds	0.03
Structural steel for railroad bridge	235,000 pounds	0.041

The proposal on which this contract was awarded was $125,452.90.

PERSONNEL

The contractor on this project was the C & R Construction Co. of Roslindale, Mass., of which Daniel Kelly is President and John Collins, Superintendent on this project. For the Massachusetts State Department of Public Works, this contract was done under the direction of J. A. Johnston, District Engineer with William E. Murphy as Resident Engineer.

Two Mixers on Concrete Base for Brick Pavement

(*Continued from page 30*)

filler material on top. This was readily peeled off with a shovel, the solution preventing sticking to the brick.

BATCHING PLANT AND CEMENT HANDLING

The batches were purchased on a tonnage basis by the contractor from the Cleveland Builder's Supply Co. and were made up at the material company's Dock No. 10. The location of this dock required a haul of 4.5 miles, by the automobile speedometer, to the batching plant and thence 0.3 miles to the job. All hauling trucks of the producer were 3 and 4-batch trucks with dual pneumatic tires on the rear wheels. The fleet consisted of a maximum of 25 trucks serving the two pavers. The batch weighed a total of 3,285 pounds for the aggregate and 490 pounds of cement. It was composed of the sand from the producer's pit and slag brought in by gondola car and unloaded to the Blaw-Knox batching plant by a locomotive crane. The two sizes of slag were 1-inch and under, and 1-inch to 2-inch. The producer's operating crew at the batching plant consisted of two men in the cars cleaning up, the batcher operator and the crane operator.

After receiving the three or four batches at the pit the trucks drove to the contractor's own cement loading plant near the site of the job. Here the bulk cement was unloaded from the box cars by two men with a scoop into the hopper of a screw conveyor which carried it across under the discharge of a storage hopper and thence to a bucket elevator which carried it up to the top of the storage bin or to the batching bin. This made it possible to deliver the cement direct for batching or rehandle it from storage if the cars were being shifted. There was also a stock of 2,000 bags of cement in the shed for emergency. The plant where the cement was batched was a complete batching plant but the cement unit alone was used. The crew consisted of three men in the car unloading to the hopper, one man on the outside watching the entire conveying operation, one batch man and one man below delivering the batches to the trucks.

PERSONNEL

The general contractor for this job was the Cleveland Trinidad Paving Co. of Cleveland, Ohio, for which J. Harold Bramley was Superintendent. The project was built under the supervision of the Ohio Department of Highways: O. W. Merrell, Director; Elmer Hilty, Chief Engineer of Construction; J. J. Jaster, Jr., Division Engineer and J. J. Coughlin, Project Engineer in charge of construction.

The Editor Comments

Personal Observations and Reflections

The Referee Should Not Be a Dictator

A static condition without change produces stagnation which is not desirable in individuals, industry or government. On the other hand, rapid, revolutionary and vacillating changes in the order of society, business or government with no time for stabilizing one's thoughts and activities are equally as disastrous to progress. Our national New Deal government at the outset caught the fancy of the nation with its completely different attitude toward the problems of the Depression. N R A was created to organize, stimulate and create self-government among the various trade groups and business willingly responded, feeling that with codes having the force of law, and self-government through honestly created Code Authorities, many of the evils which had crept into business methods could be corrected. As a result, American business and industry is, in general, in a much more wholesome condition today than for decades.

Unfortunately, the whole problem of N R A policing has become too great for the military-minded leader appointed to guide N R A on its course and, unaccustomed to diplomacy, he has adopted the typical dictatorial attitude of the military man and ordered changes faster than the minds of active business can keep pace. Today, for example, the Cement Industry does not know how it can sell its product, so rapid has been the change in the articles of its Code. Changes have been ordered, without serious consideration of the Industry itself.

Peremptory orders, military style, are robbing industry and business of the best that N R A offered, namely, self-government with Federal enforcement through the courts. Let not the New Deal destroy the value of its most outstanding contribution to the rehabilitation of business and industry, the Recovery Act, by imposing Federal dictation upon self-government.

A definite policy of less rapid, less vacillating decisions, with a return to the fundamentals of states rights, the rights of business groups to speak and regulate for themselves, will see a lessening of the rising tide of unpopularity of the New Deal Administration that is so evident among individuals and business groups. N R A should be a referee and not a dictator.

More, or Less, Hand Labor?

What a change N R A has wrought in the labor situation along the levees! Two years ago swarms of negro laborers were seen dressing slopes while today they have almost disappeared. What is the reason for this change?

Under the Public Works Administration the U. S. Bureau of Public Roads ruled out certain machinery, forcing the highway contractor to use hand labor for those grading operations. This caused severe criticism by manufacturers because it threw out many of their employees as there were no sales of the machinery formerly used for this type of work.

Now comes exactly the opposite situation—an increase in use of machinery and a decrease in the use of hand labor. On the levees on the steeper riverside slope, hand labor is still used and perhaps five men are used for each daylight shift for dressing slope. On the longer landside slope tractors and bulldozers are seen everywhere, replacing up to fifty men for each daylight shift. The reason for this is that the negro laborer was formerly paid 15 cents an hour and thrived on it. N R A raised the pay of common labor to 40 cents an hour and the negro became wealthy overnight. He did not need to work anywhere nearly as much to get the money he needed. Hence he quit after a day or two and made a tremendous labor turnover. Further, the added cost in completing the contract made it cheaper for the contractor to purchase the equipment for the work and dispense with hand labor almost entirely.

Every cloud has its silver lining, even in the construction industry!

En Route to the Southwest

This page is written while I am en route to the southwest. When you are reading it, I shall be visiting a group of interesting construction projects selected by state highway officials, U. S. Engineer Corps officers and others as outstanding contracts where unusual things are being done in a different manner. All this is done in your service that the pages of CONTRACTORS AND ENGINEERS MONTHLY may always give you just a little more of the practical story of contractors' methods in the civil engineering field than any contemporary.

Theodore Reed Kendall

How the Other Fellow Did It

Ideas That Have Already Proved Helpful to Contractors

Protection from the Sun for Machine Operators

319. The employees of a contractor with a job running through a continuous grove of pines or "spreading chestnut trees" are lucky when the weather is hot but the superintendent's view is somewhat different after a wet spell when the grade dries up slowly. This is the time of year when considerable attention must be paid to protecting machine operators from the sun. They are the important men on the job and, with the present double and sometimes triple labor organizations necessary under existing regulations, are difficult to replace. We have seen many jobs where awnings have been placed on the paver and canvas canopies over the operator's platform on finishing machines and we have seen one job where a respectably sized canvas tent was suspended from and extended in front of the paver boom so that the puddlers worked in the shade. On a Michigan contract a hand-operated machine belter was also used as the transporting unit for a home-made rig for placing the center joint. The belter carried a double platform for the man setting the center strip. Thus he could face east or west according to the sun and it was noted that he wore a handkerchief tucked under his cap to protect the back of his neck from the sun. 27.4.13

Sprinkler Trucks for Curing Concrete Slab

320. The use of sprinkler trucks for curing 10-foot concrete slab has become quite general. The trucks carry tanks varying from 500 to 700-gallon capacity and are either filled at hydrants, if the work is near an existing water supply, or are filled by small pumps, either of the outboard motor type mounted on the truck itself or regular road pumps installed on a creek bank. The sprinkler bar is usually hinged so that it can be swung against the truck when moving over the grade and then swung out to extend completely across the slab. Recently we noted one of these trucks equipped with an outboard motor on the top of the tank and found that it was used to wash out truck mixers, a fleet of which were used on the job. Plenty of water at high pressure does an excellent job at the end of the day either on your paver or your truck mixer to insure a thorough cleaning. 26.4.24

An Economical and Effective Jetting Method

321. An Alabama contractor has devised a method of his own for handling jetting operations on fills. His methods go beyond the specifications of the states in which he operates but he believes that they are economical and they surely do produce effective results entirely satisfactory to the state highway departments. First a series of holes, 2 feet deep and 5 feet on centers, is dug with post hole diggers in the section to be jetted. Then the jets, composed of 5-foot lengths of 1¼-inch pipe reduced to a jet ¾-inch in diameter at the end, are permitted to work their way down with the water running under pressure. If the crust of the ground surface is too hard, it is first plowed to permit the water that gathers at the top to penetrate into the fill over its entire area. A crew of three men and a pump man handle the jetting. The hose take-off for the jetting pipes is set every 300 feet in the main water line and the jets work close together with varying lengths of 1¼-inch hose. If it is found that the crust is thicker than can easily be broken up with a plow, the entire surface is ponded until soft enough to permit easy jetting. 27.3.15

Welding Solves Emergency Repair and Construction Problems

322. Whether welding heavy structural plates and girders or light-gage steel or castings, contractors are saving money daily through the addition of an electric arc welder to their construction equipment. Recently we learned of a job where a pile driver cylinder on a steam rig broke. To replace it would have cost $385. The contractor decided to repair it by welding, which was undertaken and resulted in a cost of only $31. Severe tests revealed that the cylinder was capable of withstanding all operating stresses. On another job a large stone crusher spider at a gravel pit broke, putting the machine out of commission. By means of welding, a patch 1¼ inches thick to fill the broken spot was applied. The job took 14 man-hours of actual welding time. While a new casting cost $1,400, the old one was salvaged at only a bare fraction of that cost. On another job in the autumn where the contractor was confronted with the necessity of completing a highway project before the ground froze too deeply, severe digging caused a steam shovel dipper to break next to a riveted seam. A new bucket was ordered but it was found that delivery could not be made in time to save the contract. A welder was hauled out to the job. The fracture was repaired and several teeth built up and hard surfaced. A day or two later the shovel was in action and the contractor completed the job in time.

PH. CR. 4.34

Curb Building with a Finishing Machine

323. On a 10-mile concrete asphalt-top project south of Nashville, Tenn., where a curb 6 inches wide and 1¼ inches high was built at either side of the concrete base, the contractor first used two men with a cradle-like carrier to shovel out concrete from the puddle and carry it back to build the curb. There were two curb form setters, one on each side, and one curb builder and a finisher on each side. Later the contractor equipped the finishing machine screeds with an attachment which finished the roadway 1¼ inches below the top of the forms. It was of such width that it pushed the material into place for the curb, leaving the curb practically finished with the exception of a little touching up by hand.

26.5.20

A Private Telephone System

324. On a 7-mile combination concrete base and natural sandstone rock asphalt contract in Tennessee, the contractor used a privately-owned telephone system, consisting of wires strung on poles which belonged to the local telephone company and magneto telephones with a ground circuit. These phones were placed at points of importance on the project, such as the paver, pump, field office and the state highway inspector's field office. As the main highway was under construction, and the detour long, the telephone system saved time in securing information in regard to the various activities or on breakdowns. It enabled the superintendent to communicate with the pump operator at all times in regard to the water pressure, with the supply house and the mechanic's shop and saved the partial expense of a service truck and mechanics' automobile. Without this system, it would have been necessary for some one to be constantly visiting the various operations via a long detour to see that everything was functioning properly. Other than the initial cost of the entire system, which was approximately $200, the system was operated with practically no expense. 27.2.29

A 1,166,000-Cubic Yard Excavation Contract

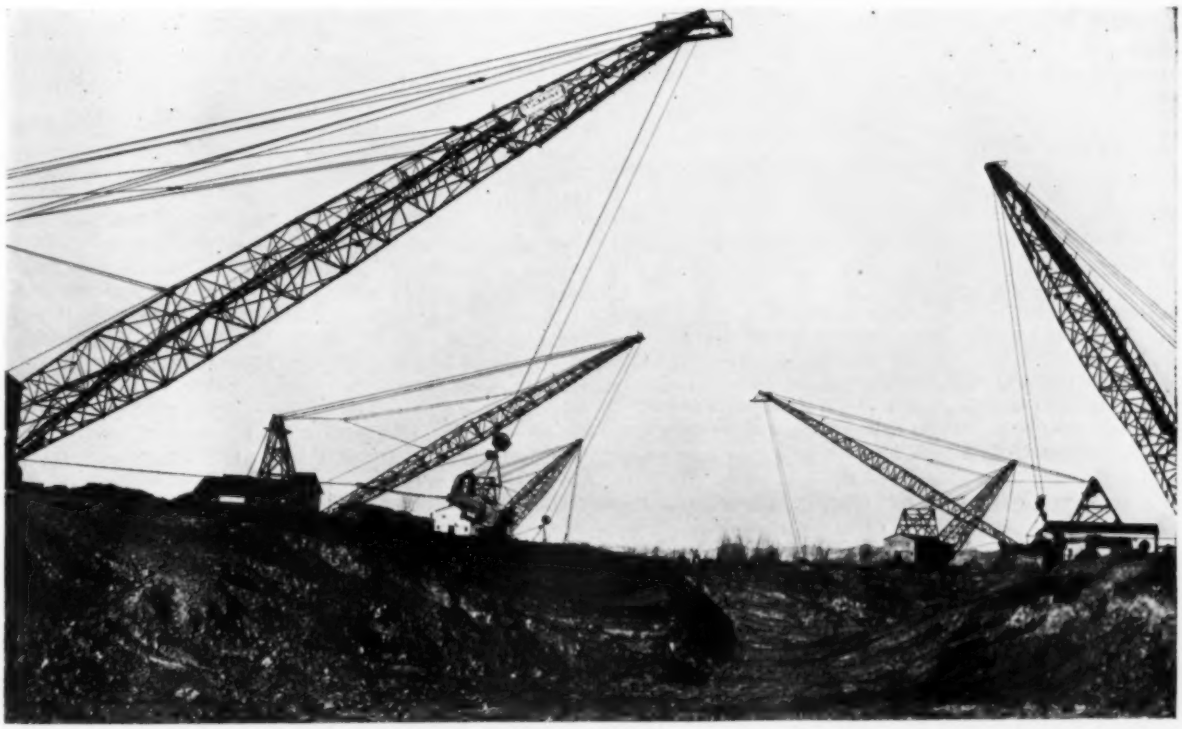
AN October 9, 1933, the first shovel of earth was dug by the contractor on the American Canyon Cut-off, thus starting the project which will shorten the distance between San Francisco and Sacramento, Calif., by 6 miles and make a vast improvement in alignment and saving in time on this important transcontinental artery. It was originally surveyed by the state in 1926 with funds supplied by the Boards of Supervisors of Solano and Napa Counties.

The work now under contract consists in the main of grading and drainage structures. In volume of excavation this project ranks among the largest ever handled in a single California state contract, there being an estimated total of 1,166,000 cubic yards to be moved with overhaul of 14,000,000 station yards. A big cut near the center of the job comes on the revised alignment where a ridge is crossed. Nearly one-half of the entire excavation on this contract will come from this one cut, where an estimated total of 520,500 cubic yards will be moved. The cut is 2,400 feet long with a maximum depth of 130 feet. Adjacent to this cut on the north, is a fill 2,500 feet long reaching a height of 75 feet which will require 605,600 cubic yards of material, to be supplied partly from the big cut and partly from another large cut to the north containing 217,300 cubic yards.

Due to the unusual size of these cuts and fills and the uncertainty as to the rock formation in the cuts, a method of terracing has been worked out. In the large cuts exceeding 30 feet in depth, it is planned to open up on pioneer slopes of ½:1 before determining the final slopes to be used. If the bedding planes of the rock stratification are very nearly horizontal, the section will be graded with a 1:1 slope extending for the entire length of the cut for the upper 30 feet of cut depth. Then a terrace and slopes of ¾:1 and ½:1 will be graded, varying in approximately 30-foot depths with a terrace between each change in slope. If, on the other hand, the strata are tipped, the slope will be increased on the side which dips toward the roadbed and decreased on the opposite side. This method of excavating should result in fewer slides, in addition to providing a method of removing slides, if any should occur.

It is planned to make the terraces with the exception of the top one 12 feet in width, which is wide enough to walk a shovel to any point along the slope which might break out subsequent to excavation. The grades of the terraces along the roadway are approximately parallel with the existing ground, with a maximum grade of 15 per cent and a 1:12 slope away from the roadway. It is believed that this terracing will help to prevent slope erosion by collecting the water on each lift and leading it to an outlet at the end of the cut, will protect the traveling public by intercepting falling rock, and will provide a method for taking out any local slides after the excavation is completed.

This text is from an article by R. E. Pierce, District Engineer, California Department of Public Works, and printed in the Department's own publication, California Highways and Public Works. The contractor for this work is Granfield, Farrar & Carlin of San Francisco, Calif.



DIGGING PILOT DITCHES FOR FLOOD CONTROL ON THE MISSISSIPPI RIVER

Six of the fifty-three Bucyrus-Monighan walking draglines on flood control work concentrated on digging pilot ditches at Willow Point Cut-Off, near Tallulah, La. These machines, from left to right, have a 160-foot boom handling a 6-yard bucket, a 150-foot boom with a 5-yard bucket, two machines with 160-foot booms and 6-yard buckets, a 150-yard boom with a 5-yard bucket and a 160-foot boom with a 6-yard bucket. Because of the necessity of rush work, it was deemed advisable for the U. S. Government to lease the machines and carry on the work instead of letting it to contractors as is usually done with most of the flood control work along the Mississippi River.

Construction Industry News

Republic Steel Corp., Massillon, Ohio, has appointed Stanley A. Knisely, of Cleveland, Ohio, to the position of Advertising and Sales Promotion Manager with headquarters at Youngstown, Ohio. He succeeds L. S. Hamaker who was recently made Vice-President and General Manager of the Berger Mfg. Co., of Canton, Ohio. Mr. Knisely has engaged in newspaper work in Canton, Ohio, and Cleveland, later became Advertising and Sales Promotion Manager of the National Paving Brick Association, and for the past seven years has been Director of Advertising and Research for the National Association of Flat Rolled Steel Manufacturers.

Western-Austin Co., Aurora, Ill., the company formed by the consolidation of the Austin Manufacturing Co., Harvey, Ill., and the Western Wheeled Scraper Co., Aurora, Ill., on June 21 elected the following officers: C. W. Sencenbaugh, Chairman of the Board; S. F. Beatty, President; H. B. Bushnell, Vice-President; K. N. Forbes, Vice-President; F. L. Jerome, Vice-President; H. M. Kleiser, Vice-President; J. L. McNab, Secretary; and McClure Kelley, Treasurer. A district sales office under the supervision of E. J. McGinty will be maintained in Chicago at 105 W. Adams St.

American Society for Testing Materials has lost through death its newly-elected president, William Hastings Bassett, who died at his home in Cheshire, Conn., on July 21. Mr. Bassett was Metallurgical Manager for the American Brass Co., Waterbury, Conn. In June, after serving a two-year term as Vice-President, he was elected President of the American Society for Testing Materials with which he had been affiliated since 1903. No decision will be made concerning Mr. Bassett's successor until the fall meeting of the Executive Committee. Until then, Dr. Hermann von Schrenk, Consulting Timber Engineer, St. Louis, Senior Vice-President of the Society, will assume the duties of the presidency.

Bucyrus-Erie Co., South Milwaukee, Wis., has suffered the loss of its Senior Vice-President, Edmund Kearsley Swigart, who died on July 7. Mr. Swigart joined the company in 1891, and was made Secretary and Treasurer in 1901. In 1910 he was made a Joint Managing Director of the company and in 1911 was elected Senior Vice-President, which position he held until his death.

Jeffrey Manufacturing Co., Columbus, Ohio, has announced the appointment of Alphonse F. Brosky as Special Engineer. Mr. Brosky resigned as Consulting Editor of Coal Age to accept this position and last winter served as Assistant Fuel Adviser to the Federal Surplus Relief Corporation in Washington.

Chicago Pneumatic Tool Co., New York City, which has for the past two years acted as general sales agent for the Mitchell Diamond Drill Co., Ltd., San Francisco, Calif., has announced the purchase of the patents, good will and tangible assets of that company and has taken over its personnel. The manufacture of Mitchell diamond drills, parts and fittings as well as ready-set bits will be continued at San Francisco for the present but later will be transferred to the plant of the Chicago Pneumatic Tool Co., at Detroit, Mich., where CP rock drills and pneumatic hammers are made.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has announced the removal of its Chicago District Office to the new Field Building, 135 South La Salle St., Chicago, Ill. B. F. Bilsland is Manager of the Chicago District. With this move Allis-Chalmers returns to its original location, for the new Field Building stands on the site of the old Home Insurance Bldg., where the general offices of the Allis-Chalmers Company were first located after the company was organized in 1901.

Stowell Construction Co., formerly of Syracuse, N. Y., has been taken over by Herman W. Rabert, its Chief Engineer since 1929, who now becomes President. The offices have been moved to Mannsville, Jefferson County, N. Y.

Chain Belt Co., Milwaukee, Wis., has announced the appointment of the Jenison Machinery Co., 20th & Tennessee Sts., San Francisco, Calif., as the distributor for Rex construction equipment in the northern part of California.

Year's Work on Federal Highways Nearly Equals Road Around Earth

RECORD speed in putting highway work under way is reported by the U. S. Bureau of Public Roads. On June 23, 1934, just one year after the apportionment of the $400,000,000 highway appropriation provided by the National Industrial Recovery Act, an average of nearly $1,000,000 per calendar day had been put to work by the state highway departments in the construction of Public Works Highways. The improvement of more than 22,000 miles of public roads and streets, a mileage which would almost reach around the world, will result from the expenditure.

The task was complicated by the fact that new relationships between Federal and State highway authorities had to be established in municipal and secondary road construction. In spite of this necessity of new relationships, the state highway departments functioned smoothly and effectively.

Employment under the program totaled 246,192 men on June 23, 1934. This is only the direct employment on the roads and does not include the workers indirectly employed in quarries, mills and factories and in the transportation of road materials, the number of which is estimated at nearly twice the direct employment.

The elimination of many traffic hazards is one of the chief results accomplished in the year's work. Narrow roads and bridges and dangerous grade crossings at both railroads and highways have been reduced in number. The Federal highway program inaugurated by the National Industrial Recovery Act not only is providing direct employment for almost a quarter of a million men and stimulating employment in industries related to highways but is serving to reduce the dangerous congestion on public highways. The passage of the Hayden-Cartwright Bill, providing $200,000,000 for highway construction for the next three years, makes it possible to continue this good work.

Awards in Annual Bridge Design Competition

THE first prize in the sixth annual bridge design competition held by the American Institute of Steel Construction was awarded to K. R. Darrah, a student at Rensselaer Polytechnic Institute. George Pistey, also a student at Rensselaer, won second prize. First honorable mention was given to David Hiat of New York University, second honorable mention to J. F. Nowak of Rensselaer, and third honorable mention to Albert R. Nozaki of the University of Illinois.

The problem was to design a steel tower for a small highway suspension bridge. The awards were made from the ten best designs selected in a preliminary competition when sixty-two students from twenty-four colleges in the United States entered drawings.

You're to Blame

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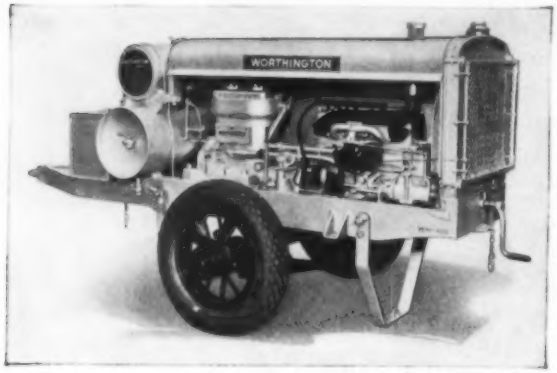


A 120-Cubic Foot Air Compressor Mounted on a Two-Wheel Speed Trailer

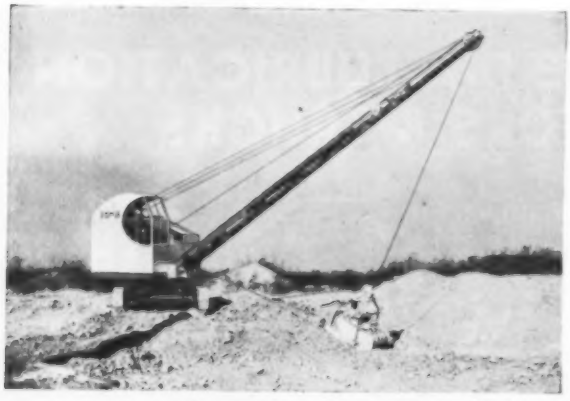
A Trailer-Mounted Air Compressor

THE Worthington 120-cubic foot air compressor, made by the Worthington Pump & Machinery Corp., Harrison, N. J., is now available in a two-wheel spring-mounted speed trailer model, especially designed for paving contractors. This unit has the standard features of the Worthington 120 air compressor, including feather valves; full force-feed lubrication; a drop-forged carefully balanced crankshaft; a cooling system consisting of extra large water jackets, a large direct-driven pump, oversize radiator, fan, large piping and water passages insuring cool, continuous operation; automotive-type pistons; all-bronze unloading plungers fitted with two piston rings to eliminate leakage of air during unloading periods; and a Continental Red Seal heavy-duty industrial gasoline engine.

Streamlines for Shovel Cab

THE front of the cab of the new small 10-B excavator, made by the Bucyrus-Erie Co., South Milwaukee, Wis., is designed in the new modern streamline style, with full vision on both sides as well as in front, providing greater work visibility, and with light reflection and sash obstruction reduced to a minimum. To conform with this design, the cab itself features sweeping curves.

The new appearance of this model typifies the new and improved mechanical features of this excavator, including heat-treated alloy steels in all wearing parts and welded construction to give structural strength. The 10-B weighs 7½ to 8 tons and travels at speeds up to 4½ miles an hour. It has a tail swing of but 5 feet 7 inches. Fully-revolving, the 10-B offers the operating efficiency and working ranges of larger shovels. Digging motions are fast, controls are responsive, making it easy for the operator to hold accurate grades. It moves readily up grades even steeper than 30 per cent.



The New Bucyrus-Erie 10-B Excavator

An Improved Highway Signal Torch

IMPROVEMENT in the design of the Economy burner used in Toledo highway signal torches and truck flares, which makes for better appearance and stronger construction, has recently been announced by the Toledo Pressed Steel Co., Toledo, Ohio.

In place of a machined screw collar fastened onto the top of the torch shell, the new construction provides a heavier drawn collar which is imbedded in the torch body over a much wider area. The new collar conforms with the general lines of the torch body and produces a compact unit. It is claimed that the lower position of the hood in relation to the body of the torch also results in an improvement in performance, as well as facilitating the installation of the hood after filling. A second improvement is found in the new one-piece wick holder, the features of which are claimed to eliminate the bleeding of oil at any time, whether the torch is burning or not. The screw collar improvement will appear hereafter on all Toledo torches, with the exception of the Champion, and the wick holder will appear on all models.

One of the Improved Highway Torches

A New Pressure Distributor for Bituminous Materials

AN improved design of pressure distributor for bituminous materials for use on motor trucks has been announced by the Good Roads Machinery Corp., Kennett Square, Pa. The tank is of oval shape with as large a section as practicable to provide maximum capacity with a minimum of length and height, thus making it adaptable to trucks of shorter wheel base. The heating system provides for two large torch-type burners directed into 7-inch diameter U-tubes and ten 3-inch diameter return flues are provided to give an extremely large heating surface and insure against unnecessary loss of time in heating the material to the proper temperature for application.

The pump is the well-known Viking pump and of a size sufficient to take care of the maximum requirement for circulation. The standard job is equipped with a heavy-duty gasoline power unit developing 30 horsepower, direct-connected to the pump and located at the front end of the tank next to the cab, where it is protected from possible damage. The tank is carried in heavy structural saddles and the whole unit is mounted on channels for installation on a truck or trailer chassis.

All accessories are of the latest improved type to add to the efficient operation of the unit. Tank lagging is optional. These distributors are offered in sizes ranging from 400 to 1,200 gallons.

FEATURES

GMC valve-in-head engine—94 h.p.—230 ft. lbs. torque—stellite exhaust valve seats—downdraft carburetor—oil reservoir air cleaner—roller bearing fan with dual "V" belt drive—9" frame—booster brakes—448.7 sq. in. braking area—cast nickel iron brake drums—radius rod drive—standard S. A. E. loading space—full floating spiral bevel rear axle—needle bearing universal joints—spoksteel wheels.

■ **It's here! A brand new General Motors Truck. A big, husky 5-ton truck—priced at the lowest figure ever quoted on a GMC of this capacity. *In fact, priced $1,000 under the average price of all other leading 5-ton trucks!***

Not only in price, but in design, construction and performance, this new GMC worker is just what thousands of owners will find exactly fitted for the job of hauling 5-ton loads more profitably.

Any GMC dealer will gladly tell you more about this latest addition to the modern, complete line of GMC quality trucks. Or an interesting descriptive booklet will be mailed upon request.

GENERAL MOTORS TRUCKS AND TRAILERS

GENERAL MOTORS TRUCK COMPANY — Time Payments Available Through Our Own Y. M. A. C. — PONTIAC, MICHIGAN

The New 10-S Dandie Trail-Mix

A New Trailer-Mixer

A NEW 10-S Dandie Trail-Mix, similar in design to the four-wheel type 10-S Dandie mixer previously described in these pages, has recently been announced by the Koehring Co., Milwaukee, Wis. The charging skip of this mixer is free from obstruction at the front and side, permitting convenient and fast loading. The machine has the Koehring automatic skip-flow shaker which actuates the skip up and down, causing shaking along the natural flow-line of the material. Anti-friction bearings, V-belt drive, automotive-type steering, and full-floating spring mounting are features of this new unit.

A New Portable Oxy-Acetylene Generator

A NEW Oxweld generator, known as the Oxweld Type MP-4, has recently been announced by The Linde Air Products Co., 30 East 42nd St., New York City. It is intended for portable service and is especially designed to withstand the severe working conditions of such service. The capacity of this new generator is 150 pounds of ¼ x ½-inch quarter-size carbide. It is rated to produce 300 cubic feet of acetylene per hour. It weighs 750 pounds empty, is 87 inches overall in height and 42¾ inches in diameter.

The feed is of the gravity type, the mechanism being of advanced design. The feed control unit is self-contained and is bolted to the inside of the carbide hopper. The feed valve unit is actuated by a diaphragm, pressure on which is exerted by a housed and loaded spring unit. At all rates of generation, the pressure variation within the generator is not more than ¾-pound per square inch. This slight variation is removed by means of a new type of regulator, particularly designed for this unit, and built into the generator. A simple filter unit is built into the rear of the regulator, so that along with the valve mechanism of the regulator, it is within the hopper shell, thus protecting both of these units from damage and minimizing freezing action in cold weather.

The two customary relief valves are used, one on the generating chamber and the other on the hydraulic back-pressure valve. A simple and dependable interference mechanism connects the relief valves to the other vital parts. The only other interference used on the generator is that between the water-filling opening and the overflow opening. These two caps are so connected by a chain that it is impossible to remove the water-filling cap until the water overflow plug has first been removed.

On one side of the generator, in a convenient position, an operating platform has been provided, on which the generator attendant can stand while charging with carbide. A step is provided for reaching the charging platform and the platform itself has a skid-proof tread plate.

For inspection of the carbide valve, a large hand-hole on the side of the generator is provided. For inspection and maintenance, it is necessary only to remove the hopper flange bolts, after which the whole top or hopper section of the generator may be raised back on a hinged joint to rest on the charging platform, thus exposing all of the interior mechanism of the generator.

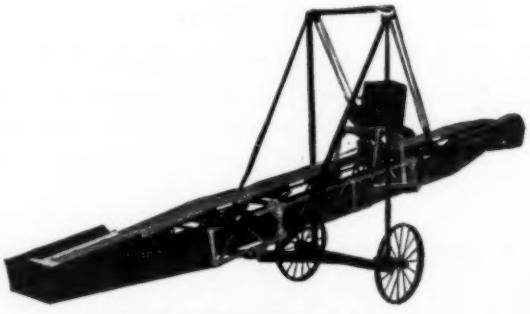
New Clutch Facilitates Handling Heavy Shovel Loads

ABILITY to balance a load of 9,050 pounds in mid-air with one finger on the control lever and without touching the brake is a feature of the Split Second power clutch recently announced by Harnischfeger Corp. Milwaukee, Wis. This device is said to increase digging speed and prevent motor stalling while the easier handling permits the operator to get more done with less fatigue in the day's work. Excessive strain and maintenance costs are reduced, as for instance when a operator strikes a 10,000-pound rock, it requires only a split second to release the power and ward off what might otherwise develop into a very costly repair bill in the heavy jolt transmitted to the revolving frame, engine and drum mechanism. This new clutch is used as well in P & H cranes to permit the operator to hoist steel beams on construction jobs accurately.

A Line of Portable Belt Conveyors

THE Northern line of portable belt conveyors, which are powered with either gasoline engines or electric motors, is manufactured by the Northern Conveyor Co., Janesville, Wis. The frame of these conveyors is deep and braced to give strength, and is made in interchangeable sections so that the conveyor can be lengthened or shortened as desired. The belt runs on three-piece troughing idlers. The rolls, which are made of machined cast iron, are open and do not collect grease inside. The head and tail drums are made of sheet steel and are crown faced. The hubs are at the extreme ends and put the load on the shaft right next to the bearings, which prevents the shaft from bending with consequent wear of bearings.

Both head and tail drums are mounted in adjustable bearings which permits accurate alignment. The boot on these conveyors is designed to prevent material getting between the belt and tail drum. There is an inverted V-shaped guard sheet between the top and return belt extending the full length of the conveyor. The truck has large roller bearing wheels with swivel arrangement and an easily-operated raising and lowering device. The conveyor is balanced in the truck. These machines are furnished any length desired up to 100 feet with any of the following widths of belts: 14, 16, 18, 20, 24 and 30 inches.



A Northern Portable Belt Conveyor

What's a load of 95,500 pounds to this stout 28-ton trailer?

ROGERS TRAILERS

Although a ROGERS is stout enough for the heaviest loads and the most grueling of tests, its light weight in proportion to capacity means extremely economical maintenance cost.

Of course, the most outstanding fact about a ROGERS is that its body is hung so low that loading it is a "cinch." Its minimum road clearance, too, is another decided advantage of a ROGERS.

There's a ROGERS for every purpose — in sizes all the way from 5 to 100 tons. Write for a copy of Catalog No. 28.

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- Pump More Hours

2", 3", 4", 6", 8" sizes. Capacities 10,000 to 125,000 g.p.h.

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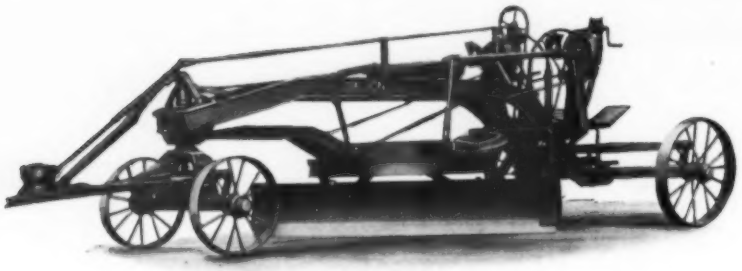


The New Galion No. 110 E-Z Lift Leaning-Wheel Grader

A Completely New Leaning-Wheel Grader

A NEW No. 110 E-Z lift manually-controlled leaning-wheel grader has been announced by the Galion Iron Works & Mfg. Co., Galion, Ohio. Weighing approximately 7,300 pounds and equipped with a 10-foot moldboard and blade, it is designed for use with tractors of from 40 to 50 hp.

Ease of operation and full visibility of the work are features of this completely new model. In addition to the usual adjustments, such as leaning the wheels and side-shifting the frame, a wider range of blade adjustments are available, making it possible to trim shoulders by extending the blade far out of line of the frame, also for setting the blade at any angle for bank cutting. These special adjustments are made without changing the machine in any manner. All wheels and blade-lifting gear worms are mounted on adjustable Timken tapered roller bearings. Moldboard adjustments are controlled by the E-Z lift gearing which operates in an oil-tight case. Where required, an efficient 11-tooth scarifier with E-Z lift control can be furnished. For ditch forming and trimming low banks, a bank sloper with V or flat bottom can be supplied.

Other features are the fully-enclosed steering hitch gearing operating in a bath of oil, the crank for pitch control operating through a worm and gear and providing 5-inch adjustment, the sturdy 7-inch all-welded channel frame and counterbalancing springs to help lighten moldboard operation.

A Portable Crushing Unit with V Belt Drive

A COMPLETE portable rock crushing and handling plant, including a crusher, elevator, chute screen, engine and drive, mounted on a four-wheel truck, ready to operate, is made by the Universal Road Machinery Co., Kingston, N. Y. Among the features of this plant are a feed opening low to the ground and at a sufficient distance from the balance wheels to make it easy and safe to feed by hand; a V belt drive from the engine to the crusher; and a clutch-equipped engine for easy starting. The plant can be moved about easily because of its roller bearing wheels and its low center of gravity makes for stability.

The crusher is a standard Reliance unit with cast steel frame, lever and jaw. The jaw plates are of manganese steel and the cheek plates of high carbon steel, with oversize bearings and shafting and high-pressure grease lubrication. The elevator is of the folding type with ample bucket capacity. The chassis has a heavy cross-braced channel frame with electric welded headers. Le Roi, Waukesha or Continental industrial units with a clutch provide the power. The unit is mounted on a special roller bearing four-wheel truck, the rear wheels fitted with a heavy axle, the front wheels with a gooseneck attachment and with a short turning radius. The disc wheels are of the heavy-duty type, Timken bearing equipped, 25 inches in diameter and carrying an 8 to 12-inch tire.

This Reliance unit can be furnished with or without the elevator; a chute screen can be supplied if desired, or a portable bin with a revolving screen, depending on the number of separations of materials required.

A Two-Wheel Machinery and Materials Trailer

A TWO-WHEEL trailer for moving machinery or material, which can be used with any automobile, truck or tractor, is manufactured by the Moloch Foundry & Machinery Co., Kaukauna, Wis. This Atlasta trailer can easily be loaded or unloaded by one man and the feature of its tilting platform, forming its own loading ramp, eliminates high lifts. Its construction permits width and length of platform to suit the needs of the contractor and its patented spring suspension is designed to prevent side sway.

Other features of this trailer are the draw bar which is securely locked when trailing; a hand winch enabling one man to handle loading or unloading; automotive frame construction; stake sockets making it possible to erect side boards; Timken roller bearing wheels; and pneumatic tires. Its capacity ranges from ¾-ton to 10 tons, the platform length varying from 8 feet to 16 feet. All standard trailers are within the 8-foot width as required by law. Wider platforms are available but such trailers must be operated on public highways under special permit.

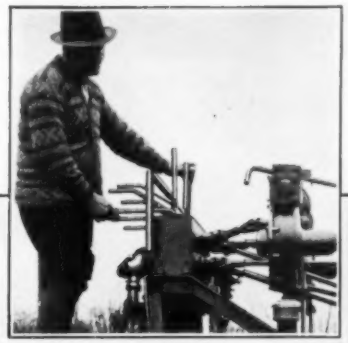
An Atlasta Trailer Being Pulled by a Truck and Showing the Tilted Platform Which Makes for Easy Loading

Does the Toughest Jobs

WITH UTMOST EASE OF OPERATION

HEAVY construction or reconstruction suggests the use of a power controlled Adams Leaning Wheel Grader No. 121. This machine gets things done in a big way, at low cost. Cutting and finishing banks, ditches, sub-grades, and berms—all to specifications—are its regular routine. It also tears up old gravel or stone bases easily.

Convenient levers in front of the operator make the blade, scarifier, leaning wheels, steerable tongue, etc.—respond instantly to the touch. Two or more adjustments can be made as quickly and easily as one, thus saving time, money and energy.



Adams Leaning Wheel Grader No. 121 is available with 10, 12 or 14 ft. blades and with or without scarifier. Smaller graders available in 6½, 7, 8, 9, 10 and 12 ft. blade lengths.

Mail the coupon below for Adams Leaning Wheel Grader catalog completely describing this machine. Also inquire about Adams Motor Graders, Elevating Graders, Multiple-Blade Maintainers, Retread Pavers, Rotary Scrapers, Dump Trailers, etc.

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Asphalt for Road Contractors

101 Complete information on the use of Texaco asphalt in the construction of roads of long life, as well as many examples of roads which have been built with Texaco asphalt, may be secured by interested contractors and engineers from the Texas Co., Asphalt Sales Dept., 135 E. 42nd St., New York City.

Keeping Engines Clean

102 Air-Maze Corp., 311 Caxton Bldg., Cleveland, Ohio, will be glad to send to those interested complete information on the Air-Maze air filter of the oil-bath type which is designed to remove all dirt from the air before it enters the carburetor and thus protect the engine from dirt and grit and the necessity of time out for repairs.

Trucks for Contractors

103 Interested contractors may secure complete information on Chevrolet valve-in-head 6-cylinder trucks, which are designed for economical and reliable performance, from the Chevrolet Motor Co., Detroit, Mich.

Oil-Engine Power Units

104 Waukesha-Hesselman oil-engine power units, in sizes from 25 to 95 hp. with four cylinders and 90 to 230 hp. with six cylinders, which burn cheap fuel oils and are adaptable to all types of construction equipment, are described in Bulletin 905 which the Waukesha Motor Co., Waukesha, Wis., will be glad to send on request.

Lubricants for Heavy-Duty Equipment

105 Complete information and prices on D-A lubricants, especially made for the lubrication of tractors, trucks and all other heavy-duty construction equipment, may be secured by interested contractors from the D-A Lubricant Co., Inc., Indianapolis, Ind.

A Line of Modern Construction Equipment

106 Heltzel Steel Form & Iron Co., Warren, Ohio, will be glad to send to interested contractors complete information on its line of construction equipment, including Heltzel steel forms for roads and sidewalks, steel bins, portable batching plants, subgrade testers, trail graders, strike-offs, traveling bridges, mechanical spreaders and surfacers, road joint installing machines, hand finishing tools, straight-edges, floats and miscellaneous equipment.

Rugged Road Rollers

107 Buffalo-Springfield Roller Co., Springfield, Ohio, will be glad to send to those interested complete information on its line of road rollers, which are made in a variety of sizes, either tandem or three wheel, a feature of which is the ruggedness of design and construction.

A New 3-Ton Truck

108 Complete information on the new 3-ton GMC truck, which has a number of new and improved features designed for dependability and economy of operation, may be secured by those interested from the General Motors Truck Co., Pontiac, Mich.

A New 1¼-Yard Convertible Shovel

109 Bucyrus-Erie Co., South Milwaukee, Wis., will be glad to send to interested contractors complete information on the new Bucyrus-Erie 1¼-yard 34-B shovel, which is fully convertible, offering service as a shovel, dragline, clamshell, drag shovel or lifting crane, is available with gasoline, diesel or electric power and has a number of new and interesting features.

Oil-Engine-Driven Air Compressors

110 Ingersoll-Rand Co., 11 Broadway, New York City, will be glad to send to interested contractors complete information on its new line of I-R two-stage oil-engine-driven portable air compressors which are available in six sizes of 75, 125, 185, 250, 370 and 500 cubic foot capacities.

An Electric-Powered Hydraulic Dredge

111 The Amsco 8-inch pump size electric-powered hydraulic dredge for sand production, which is designed to secure the sturdiest construction at a minimum investment, is easily operated and is capable of producing materials dependably and economically, is described and illustrated in Bulletin P7 which the American Manganese Steel Co., Chicago Heights, Ill., will be glad to send on request.

A New Trailer-Mixer

112 A complete description of the new 10-S Dandie Trail-Mix, similar in design to the four-wheel type 10-S Dandie mixer and with the same Koehring features, but mounted on a two-wheel trailer, may be secured by interested contractors from the Koehring Co., Milwaukee, Wis.

A Two-Wheel Machinery and Material Trailer

113 Literature describing the Atlasta two-wheel machinery and material trailer, which can be used with any automobile, truck or tractor, a feature of which is its tilting platform, forming its own loading ramp, and which can easily be loaded or unloaded by one man, may be secured by interested contractors from the Moloch Foundry & Machine Co., Kaukauna, Wis.

A New Booklet on the Methods of Sampling Soils for Road Stabilization

114 Bulletin No. 3, issued by the Solvay Sales Corp., 61 Broadway, New York City, describes the methods and equipment necessary for sampling and testing soils and calculating stabilized soil mixtures. The booklet contains chapters on equipment necessary, quantity of sample required, method of testing soils, materials specifications and considerable other data which should prove of great value to highway engineers.

A New Automatic-Feed Self-Rotating Drill

115 Complete information on the new Gardner-Denver D-89 Selfeed drifter, which embodies a new principle of self-feed, is vibrationless, and has self-controlled positive action, making it possible for an inexperienced man to drill as fast as an experienced operator, may be secured by those interested from the Gardner-Denver Co., Quincy, Ill.

Steel Plate Highway Guard Rail

116 Tuthill Spring Co., 760 Polk Ave., Chicago, Ill., will be glad to send to interested contractors and highway engineers complete information on the Tuthill steel plate highway guard rail, which is strong, effective and easy to erect.

A 10-S Concrete Mixer

117 Complete information on the Lansing 10-S concrete mixer, features of which are its capacity of 10 cubic feet of mixed concrete per batch, Alemite pressure lubrication, rubber-tired wheels, heavy-duty Hyatt roller bearings, LeRoi power, and one-man control, may be secured by interested contractors from the Lansing Co., Lansing, Mich.

Lubricants for Construction Equipment

118 Fiske Brothers Refining Co., 24 State St., New York City, will be glad to send to interested contractors complete information on Fiske's cup greases, pressure lubricants, gear greases and shields, cable dressings, roller bearings greases, transmission lubricants, universal joint grease, fibre greases and other lubricants for maintaining the efficiency of construction equipment.

A New Portable Crushing Outfit

119 Bulletin P-34 describing the developments in Telsmith portable crushing outfits, the new features of which are designed for greater capacities and more economical operation, may be secured by interested contractors from the Smith Engineering Works, 4014 N. Holton St., Milwaukee, Wis.

All Steel Hand Hoists

120 Beebe all-steel hand hoists, with a straightline capacity of 5 tons, two speeds of 4 to 1 and 24 to 1 and positive internal brake, are described in literature which Beebe Bros., 2724 Sixth Ave., So., Seattle, Wash., will be glad to send on request.

A Portable Road-Trailer-Type Arc Welder

121 Literature describing the Universal road-trailer-type arc welder, features of which are the new Ford V-8 power unit and the use of the Staidarc principle for arc stabilization, which can easily be attached to any truck or car and towed at high road speeds, may be secured by interested contractors from the Universal Power Corp., 1719 Clarkstone Road, Cleveland, Ohio.

(Continued on page 52)

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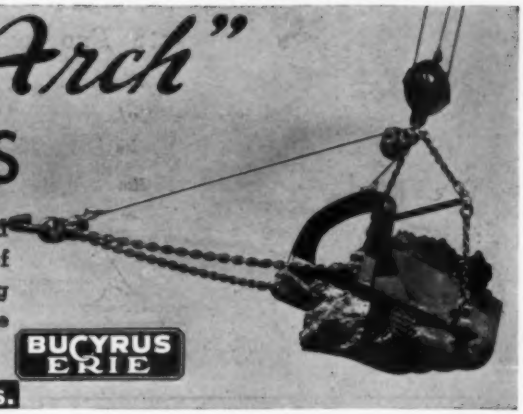

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Everyone shook his head. "What! A 45-foot Finishing Machine?—Impossible."
Nevertheless, The Garaux Brothers Company ordered one for their job through the heart of Canton, Ohio. It weighed seven tons; screed, two tons. Two 20-horsepower four-cylinder motors propelled it. Additional to screeding, three lines of longitudinal ribbon joints, and transverse ribbon joints every 25 feet were installed. Eight driving wheels ran on Heltzel Standard Steel Forms. Two mixers delivered the concrete. The job was completed four months ahead of schedule.

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Reduces Hauling Cost

Use of high-strength aluminum alloy saves 40 pounds in the dead load, permitting an increase of 15% in the pay load. Because of the increased pay loads, the entire cost is eliminated in from 30 to 60 days.
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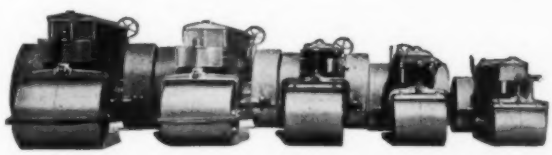

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Your roller is here—whether you are looking for a heavyweight 17-ton three-wheeler or bantamweight 2½-ton tandem. Each BUFFALO-SPRINGFIELD is the champion in its weight class. And one of these BUFFALO-SPRINGFIELDS is just the right size and weight for *your* needs. Select it from our illustrated booklet.

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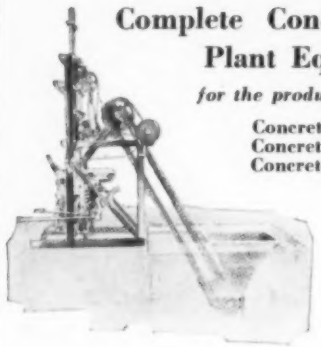
Concrete Bricks

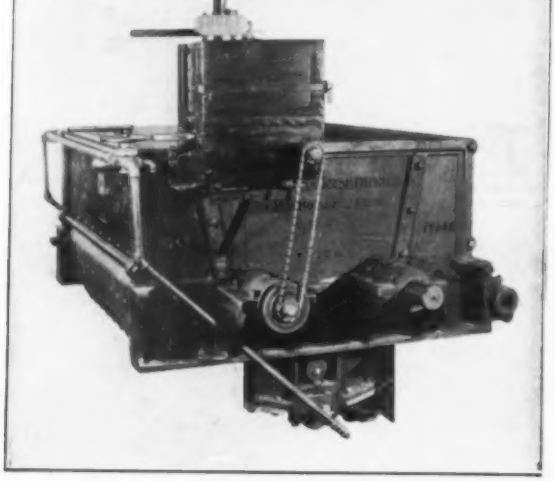
Write for Literature



Miles CONCRETE EQUIPMENT

The Miles Mfg. Co.
Jackson, Mich.

TIME LOCKING DEVICE
For Bituminous Mixer
All Mechanical
Complies with State Highway Specifications
Adaptable to any plant



Send for Bulletin TL-10

HETHERINGTON & BERNER INC.
INDIANAPOLIS, IND.
Builders of Asphalt Paving Machinery for 30 Years

A HANDY TRAILER MIXER

This 3½-cubic-foot Trailer Mixer may be loaded or discharged from either side, as it is fitted with an interchangeable lock. Ball bearing head with few wearing parts. It is easily and quickly moved from one job to the next because of its strong rubber-tired steel wheels (with 6-inch hubs). Power is furnished by a reliable 1¾-hp. engine.

Write for complete specifications

The J. B. Foote Foundry Co.
Fredericktown, O.

Up-to-Date Machinery and Materials

(*Continued from page 50*)

A New Line of Vibrator Crushing and Screening Plants

122 Pioneer Gravel Equipment Mfg. Co., 1519 Central Ave., Minneapolis, Minn., will be glad to send to interested contractors literature describing its new line of vibrator plants, features of which are easy portability, vibrator-type SKF roller bearing screens, greater screening area, low-pitch conveyors, folding bucket elevators and proper road clearance widths.

Rigid Easily-Cleaned Road Forms

123 Literature describing Metaforms, a rigid road rail which is easily set up and taken down, is rugged and durable, with an 8-inch base giving greater stability, and which does not pile up with concrete, may be secured by interested contractors and highway engineers from the Metal Forms Co., 3334 Booth St., Milwaukee, Wis.

The Progress of Bronze-Welding

124 This is the title of an 8-page bulletin describing the application of this type of welding in the construction and maintenance of equipment which interested contractors and engineers may secure from The Linde Air Products Co., 30 East 42nd St., New York City.

Equipment for Bituminous Road Construction

125 Complete information on Hvass equipment for bituminous road construction, including bituminous distributors, heavy-duty trailers, sand and chip spreaders, sweepers, and heating kettles, may be secured by those interested from Chas. Hvass & Co., Inc., 508 E. 19th St., New York City.

Large Capacity Portable Air Compressors

126 Bulletin C-6-B, containing complete information on Curtis portable air compressors, features of which are their large capacities, from 40 to 300 cubic feet, removable valve assemblies, and Timken bearings adjustable for wear, may be secured by interested contractors from Curtis Pneumatic Machinery Co., 1931 Kienlen Ave., St. Louis, Mo.

Machinery for Concrete Products

127 A complete line of equipment for the production of concrete blocks, building tile, bricks and similar materials is described in literature which the Miles Manufacturing Co., Jackson, Mich., will be glad to send on request.

Light-Weight Wheelbarrows

128 Sheet Aluminum Corp., Jackson, Mich., will be glad to send to interested contractors literature describing the Hyb-Lum wheelbarrow which is made from high-strength nickel aluminum alloy, making the wheelbarrow light in weight and therefore increasing the pay load.

A New Door Wind-Up for Dump Wagons

129 Trackson Co., Milwaukee, Wis., will be glad to send to interested contractors complete information on its new power door wind-up attachment for bottom-dump crawler wagons, which is simple, dependable, inexpensively mounted on various types of bottom-dump wagons, is operated by the tractor driver and eliminates the hazards of men climbing on and off the wagons while in motion.

A New One-Man Patrol Unit

130 The Austin-Western Road Machinery Co., Aurora, Ill., has recently brought out the Austin No. 8 one-man patrol, rugged, highly-simplified and easy-operating maintainer. Complete details will be furnished on request.

A Line of Portable Belt Conveyors

131 The Northern line of portable belt conveyors, which are made in belt widths of 14, 16, 18, 20, 24 and 30 inches in lengths up to 100 feet, with interchangeable frame pieces so that the unit may be lengthened or shortened as desired, and powered with either gasoline engines or electric motors, is described in literature which interested contractors may secure direct from the Northern Conveyor Co., Janesville, Wis.

A Completely New Leaning-Wheel Grader

132 Bulletin No. 169, describing and illustrating the new Galion No. 110 E-Z lift manually-controlled leaning-wheel grader, which has a number of new and improved features, may be secured by interested contractors direct from Galion Iron Works & Mfg. Co., Galion, Ohio.

A New Welding Electrode for Mild Steel

133 The Lincoln Electric Co., Cleveland, Ohio, will be glad to send to interested contractors and welder operators complete information on the new Fleetweld No. 7, a general-purpose heavily coated electrode for welding with the shielded arc on mild steel, which is made in diameters of ⅛, 5/32, 3/16, 7/32, ¼, 5/16, and ⅜-inch in 14-inch lengths.

New Scraper for Self or Shovel Loading

134 R. G. Le Tourneau, Inc., P. O. Box 1290, Stockton, Calif., will be glad to send to interested contractors complete information on the Super-Carryall 12-yard scraper, features of the new design of which are the elimination of center obstructions through the carrying bowl, thus making it possible to load by shovel or dragline, as well as by the conventional self-loading method, and the use of low pressure 20-inch tires which were especially designed for construction work.

A New Form Tightener

135 Complete information on the new Marion form tightener, which eliminates the twisting of wire under tension and makes the accurate alignment of forms easy and economical, may be secured by interested contractors from the Marion Malleable Iron Works, Marion, Ind.

New Catalog on Road Maintenance and Construction Equipment

136 Complete information on road maintenance and construction equipment is contained in Catalog J recently issued by Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio. The catalog contains information on oil-burning, wood-burning or coal-burning maintenance and construction kettles, oil burner and heater units, road oiling equipment, tools and miscellaneous equipment. Copies of this catalog will be sent to any interested contractor direct from the manufacturer.